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# A survey of amphibians and reptiles in the foothills of Mount Kupe, Cameroon

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**Abstract.—We performed surveys at several lower elevation sites surrounding Mt. Kupe, a mountain at the southern edge of the Cameroonian Highlands. This work resulted in the sampling of 48 species, including 38 amphibian and 10 reptile species. By combining our data with prior survey results from higher elevation zones, we produce a checklist of 108 species for the greater Mt. Kupe region including 72 frog species, 21 lizard species, and 15 species of snakes. Our work adds 30 species of frogs at lower elevations, many of which are associated with breeding in pools or ponds that are absent from the slopes of Mt. Kupe. We provide taxonomic accounts, including museum specimen data and associated molecular data, for all species encountered. Finally, we compare the levels of biodiversity of Mt. Kupe to other regions, discuss biogeographic ties to other montane systems, and note current conservation threats.**

**Keywords.** Africa, Anura, biodiversity, biogeography, Cameroon, herpetofauna, lowland forest

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## Introduction

The Cameroon Volcanic Line (CVL), also referred to as the Cameroonian Highlands (or la dorsal camerounaise), is a series of insular-like reliefs including oceanic (Annobón, Sao Tomé, Príncipe) and continental (Bioko) islands, and mainland volcanic ranges such as Mt. Cameroon (4,085 m), Mt. Kupe (2,064 m), Manengouba (2,411 m), and Mt. Nlonako (1,822 m). The CVL continues through the Bakossi Highlands and Bamenda Highlands, including the Bamboutos Mountains (2,740 m), Mt. Léfo (2,550 m), and Mt. Oku (3,011 m), ultimately ending at the Adamawa (Adamaoua) Plateau, where Tchabal Mbabo (2,460 m) is located. Though these montane regions exhibit both high species richness and endemism, beyond larger summaries of Cameroonian reptiles and amphibians (Chirio and LeBreton 2007; Amiet 2012) detailed faunal reports for particular mountains are not common. A growing number of surveys have provided baseline checklists for reptiles or amphibians of particular sites, including Mt. Cameroon, Mt. Nlonako, Mt. Kupe, Mt. Oku, and Tchabal Mbabo (Amiet 1975; Hofer et al. 1999, 2000; Plath et al. 2004; Herrmann et al. 2005a, 2005b; Herrmann et al. 2006; Gonwouo et al. 2007; Ineich et al. 2015; Hirschfeld et al. 2016). Through this work, elevational distribution and biogeographic patterns have emerged, though information for many regions is incomplete or absent. Where elevational data are available, recent work demonstrates declines in amphibian populations on several mountains, including Mt. Manengouba and Mt. Oku (Hirschfeld et al. 2016). Inventories of the herpetofauna of Mt. Nlonako, including sites ranging from 400–1,700 m elevation, resulted in the documentation of 93 amphibian and 89 reptile species, making it

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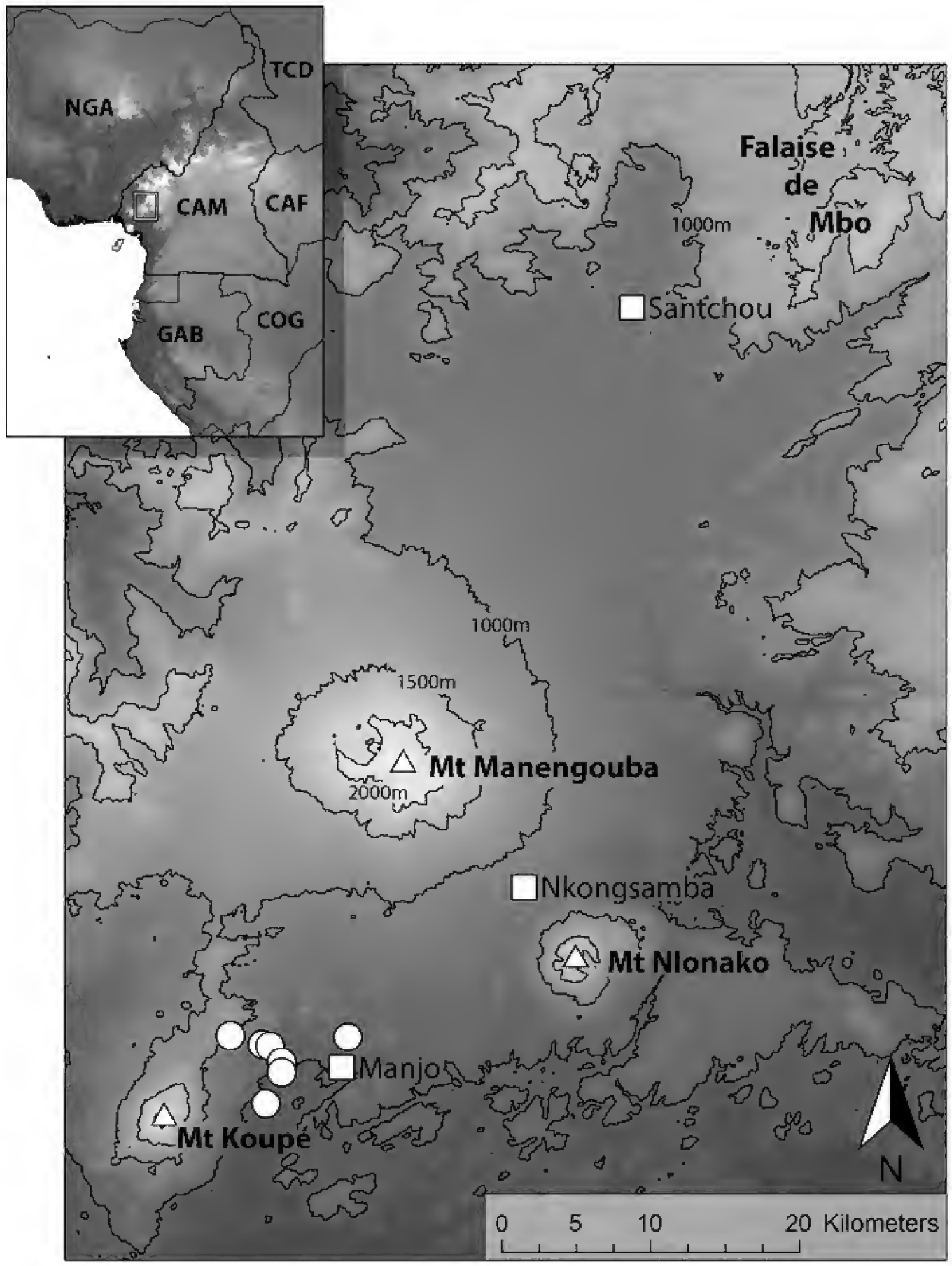


**Fig. 1.** Map of Cameroon with the location of several summits labeled, including Mt. Kupe, Mt. Manengouba, and Mt. Nlonako (white triangles), and major towns (white squares). Localities sampled for this study are denoted by white circles. Elevation is indicated by contour lines and shading, with lighter colors representing higher elevation.

one of the most species-rich mountains in tropical Africa (Amiet 1975; Plath et al. 2004; Herrmann et al. 2005a, 2005b). Several distinctive anuran faunas converge in this region (Amiet 1975), partially explaining the high species richness. Recent survey and museum work across the CVL continues to result in discovery of new species (Böhme and Schmitz 1996; Amiet and Dowsett-Lemaire 2000; Boistel and Amiet 2001; Herrmann et al. 2004; Rödel et al. 2004; Plath et al. 2006; Blackburn 2008; Blackburn et al. 2009, 2010; Zimkus and Gvoždík 2013), further demonstrating the need to better characterize the herpetofauna in these regions.

Mount Kupe (also referred to as Mont Koupé) lies just east of the Bakossi Mountains, south of Mt. Manengouba, and southwest of Mt. Nlonako (Fig. 1). Mt. Kupe rises to 2,064 m, and is most comparable in size and elevation to Mt. Nlonako. Several vegetation zones occur around Mt. Kupe, including lowland forest (300–900 m) in the foothills, submontane forest (900–1,800 m), transitional montane forest (>1,800 m), and small grassy clearings at the peak (>2,000 m) (Thomas 1986; Hofer et al. 1999, 2000). The primary lowland forest (below 900 m) has been greatly reduced or degraded by logging and subsistence or commercial agriculture (Hofer et al. 1999, 2000; pers. obs.). Streams can be located up to 1,500 m on the slopes of Mt. Kupe, but permanent ponds are only found at lower elevations (<900 m) (Hofer et al. 1999, 2000). Hofer et al. (1999, 2000) surveyed transects largely

through the submontane forest in an effort to characterize species turnover across an elevational gradient (900–2,000 m). Their work resulted in the documentation of 33 amphibian, 15 lizard, and nine snake species. However, this is a conservative estimate as no lowland forest sites or sites containing permanent ponds or temporary pools were surveyed.

During two periods in 2013 and 2014, we conducted herpetological surveys in the foothills of Mt. Kupe, adjacent to the town of Manjo (Fig. 1) in a region known as the Tombel Plain, that lies between the headwaters of the Moungo and Dibombé rivers (Amiet 1975). Here, we discuss the results of our survey work based on a collection of 488 specimens. In an effort to more fully characterize our results, representatives of all species were DNA-barcoded using the 16S mitochondrial marker (Table 1). We provide taxonomic accounts, including museum specimen data and associated molecular data, for all species encountered. We also make comparisons to previous surveys at higher elevations on Mt. Kupe (Hofer et al. 1999, 2000) and several low elevation sites (Lala, 4.80°N, 9.76°E, 480 m; Maholé 4.82°N, 9.61°E, 300–350 m; Nlohé, 4.75°N, 9.75°E, 350 m) near Mt. Kupe (Amiet 1975).

## Methods

We conducted surveys at multiple sites in the foothills of Mt. Kupe, accessed through the nearby town of Manjo. Surveys were conducted by DMP, GFMJ, and MTK during July 11–14, 2013, and by DMP, GFMJ, LAS, BF, WPT, and DCB during September 24–29, 2014, for a total of ten days. A combination of sites was chosen to maximize the habitats surveyed, and included permanent ponds in semi-disturbed forest (Fig. 2A), fish ponds (Fig. 2B), large streams in disturbed habitat (Fig. 2C), small streams in secondary forest (Fig. 2D), and anthropogenic habitats (Fig. 2E). Though primary forest is intact at lower elevations, a lack of accessibility, permissions, and time precluded sampling at these sites. All localities visited are lowland forests or lower strata of submontane forests (between 470–1,010 m). The short time period for surveys precluded the use of pitfall traps and other systematic techniques, and all specimens were hand-captured during diurnal and nocturnal visual searches. We euthanized captured animals using MS-222, preserved tissue samples in RNA Later (Ambion, Inc.), and preserved whole specimens with 10% buffered formalin. During this process we took relevant body size measurements for each specimen to the nearest 0.5 millimeters (Reptiles—snout-vent length: SVL; tail length: TL; Amphibians—snout-urostyle length: SUL). When possible, we recorded the sex of specimens based on a variety of observations. For amphibians this included: 1) male secondary sexual characters such as nuptial pads, vocal sacs, elongated fingers, gular glands, tympanic papillae, 2) the tracking of specimens found in amplexus, and 3) the discovery of eggs in gravid females during tissue collection. For reptiles this included: 1) male secondary sexual characters such as coloration or preanal pores, and 2) eversion of hemipenes during the fixation process. In the absence of such characters, we did not attempt to sex specimens based on destructive dissection. In the species accounts we only report the sex of adult specimens for which we are confident, but do not distinguish between the reasons for our inability to determine sex (i.e., juveniles vs. lack of external characters). In the absence of these data, we still include relevant size measurements for all unsexed adult specimens, which is often useful for distinguishing between closely related species. After fixation, specimens were moved to 70% EtOH for long-term storage. All 488 specimen vouchers and associated tissue samples are deposited at the California Academy of Sciences (CAS).

We performed DNA barcoding on a subset of 92 specimens to confirm morphological identifications and/or to generate sequence data for underrepresented groups. Whole genomic DNA was extracted from liver samples using a high-salt DNA extraction (Aljanabi and Martinez 1997). We obtained sequence data from the mitochondrial marker 16S ribosomal RNA (16S) using primers 16SA and 16SB (Palumbi et al. 2001). Polymerase chain reactions (PCRs) were carried out in 12.5 µl volumes consisting of: 1.25 µl Roche 10x (500 mM Tris/HCl, 100 mM KCl, 50 mM $(NH_4)_2$ $SO_4$, 20 mM $MgCl_2$, pH=8.3), 0.75 µl 25 mM $MgCl_2$, 0.75 µl 2 mM DNTPs, 0.25 µl 10.0 µM forward primer, 0.25 µl 10.0 µM reverse primer, 8.40 µl $H_2O$, 0.10 µl Taq, and 0.75 µl DNA. Amplification of 16S involved initial denaturation at 94 °C for four minutes, followed by 35 cycles of 95 °C for 60 s, 51 °C for 60 s, 72 °C for 90 s, and a final extension at 72 °C for seven minutes. The PCR amplifications were visualized on an agarose gel and cleaned using ExoSAP-IT (USB). Gene products were sequenced using BigDye v3.1 on an ABI3730 (Applied Biosystems). All newly generated sequences are deposited in GenBank (Accession numbers: KX671711–802; Table 1).

## Species Accounts

### ANURA

### Arthroleptidae

*Arthroleptis poecilonotus* Peters, 1863. Figure 3A, B; 23 specimens. 4.8148°N, 9.7691°E (475 m): (2014) CAS 256686–89. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256711, 256809–10. 4.8498°N, 9.7718°E (513 m): (2013) CAS 254029–39. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256824–27. 4.8247°N, 9.7702°E (494 m): (2013) CAS 253867. The SUL of unsexed individuals ranges from 12.5–28.5 mm (average: 20.6, $n = 23$).

**Table 1.** List of taxa, museum numbers, and GenBank numbers for 16S mitochondrial sequence data.

| | Genus | Species | Museum No. | Gen Bank No. |
|---|---|---|---|---|
| Anura | *Afrixalus* | *dorsalis* | CAS253854 | KX671711 |
| | *Afrixalus* | *dorsalis* | CAS253855 | KX671712 |
| | *Afrixalus* | *dorsalis* | CAS256690 | KX671713 |
| | *Afrixalus* | *dorsalis* | CAS256691 | KX671714 |
| | *Afrixalus* | *laevis* | CAS254071 | KX671715 |
| | *Afrixalus* | *paradorsalis* | CAS253947 | KX671716 |
| | *Afrixalus* | *paradorsalis* | CAS253948 | KX671717 |
| | *Afrixalus* | *paradorsalis* | CAS256750 | KX671718 |
| | *Afrixalus* | *paradorsalis* | CAS256751 | KX671719 |
| | *Amietophrynus* | *regularis* | CAS256712 | KX671721 |
| | *Amietophrynus* | *regularis* | CAS256713 | KX671722 |
| | *Arthroleptis* | *poecilonotus* | CAS253867 | KX671723 |
| | *Arthroleptis* | *poecilonotus* | CAS254029 | KX671724 |
| | *Arthroleptis* | *poecilonotus* | CAS256686 | KX671725 |
| | *Cardioglossa* | *elegans* | CAS256915 | KX671726 |
| | *Cardioglossa* | *leucomystax* | CAS256874 | KX671727 |
| | *Chiromantis* | *rufescens* | CAS254025 | KX671728 |
| | *Conraua* | *goliath* | CAS256830 | KX671730 |
| | *Conraua* | *robusta* | CAS256822 | KX671731 |
| | *Hyperolius* | *bolifambae* | CAS253883 | KX671736 |
| | *Hyperolius* | *bolifambae* | CAS253884 | KX671737 |
| | *Hyperolius* | *bolifambae* | CAS253885 | KX671738 |
| | *Hyperolius* | *camerunensis* | CAS253935 | KX671739 |
| | *Hyperolius* | *camerunensis* | CAS256916 | KX671740 |
| | *Hyperolius* | *concolor* | CAS253869 | KX671741 |
| | *Hyperolius* | *concolor* | CAS253874 | KX671742 |
| | *Hyperolius* | *dintelmanni* | CAS253991 | KX671743 |
| | *Hyperolius* | *dintelmanni* | CAS256693 | KX671744 |
| | *Hyperolius* | *fusciventris* | CAS254005 | KX671745 |
| | *Hyperolius* | *fusciventris* | CAS254006 | KX671746 |
| | *Hyperolius* | *ocellatus* | CAS254057 | KX671747 |
| | *Hyperolius* | *ocellatus* | CAS254058 | KX671748 |
| | *Kassina* | *decorata* | CAS253990 | KX671749 |
| | *Leptopelis* | *aubryi* | CAS253851 | KX671750 |
| | *Leptopelis* | *aubryi* | CAS253852 | KX671751 |
| | *Leptopelis* | *aubryi* | CAS256685 | KX671752 |
| | *Leptopelis* | *aubryioides* | CAS253974 | KX671753 |
| | *Leptopelis* | *aubryioides* | CAS256719 | KX671754 |
| | *Leptopelis* | *boulengeri* | CAS253980 | KX671755 |
| | *Leptopelis* | *boulengeri* | CAS256875 | KX671756 |
| | *Leptopelis* | *calcaratus* | CAS253981 | KX671757 |
| | *Leptopelis* | *calcaratus* | CAS253982 | KX671758 |
| | *Leptopelis* | *rufus* | CAS254045 | KX671759 |
| | *Leptopelis* | *rufus* | CAS254048 | KX671760 |
| | *Leptopelis* | *rufus* | CAS256682 | KX671761 |
| | *Leptopelis* | *rufus* | CAS256683 | KX671762 |

**Table 1 (continued).** List of taxa, museum numbers, and GenBank numbers for 16S mitochondrial sequence data.

| | Genus | Species | Museum No. | Gen Bank No. |
|---|---|---|---|---|
| | *Leptopelis* | *rufus* | CAS256882 | KX671763 |
| | *Nyctibates* | *corrugatus* | CAS256829 | KX671764 |
| | *Petropedetes* | *cameronensis* | CAS256887 | KX671766 |
| | *Petropedetes* | *cameronensis* | CAS256888 | KX671767 |
| | *Petropedetes* | *euskircheni* | CAS254066 | KX671768 |
| | *Petropedetes* | *euskircheni* | CAS254067 | KX671769 |
| | *Phlyctimantis* | *leonardi* | CAS253978 | KX671770 |
| | *Phlyctimantis* | *leonardi* | CAS253979 | KX671771 |
| | *Phrynobatrachus* | *africanus* | CAS253989 | KX671772 |
| | *Phrynobatrachus* | *africanus* | CAS256872 | KX671773 |
| | *Phrynobatrachus* | *auritus* | CAS256669 | KX671774 |
| | *Phrynobatrachus* | *auritus* | CAS256670 | KX671775 |
| | *Phrynobatrachus* | *auritus* | CAS256674 | KX671776 |
| | *Phrynobatrachus* | *cornutus* | CAS256868 | KX671777 |
| | *Phrynobatrachus* | *cornutus* | CAS256869 | KX671778 |
| | *Phrynobatrachus* | *cornutus* | CAS256870 | KX671779 |
| | *Phrynobatrachus* | *cornutus* | CAS256871 | KX671780 |
| | *Phrynobatrachus* | *cornutus* | CAS256873 | KX671781 |
| | *Phrynobatrachus* | sp. | CAS256714 | KX671782 |
| | *Phrynobatrachus* | sp. | CAS256715 | KX671783 |
| | *Ptychadena* | cf. *aequiplicata* | CAS254024 | KX671789 |
| | *Ptychadena* | cf. *aequiplicata* | CAS254054 | KX671790 |
| | *Ptychadena* | cf. *aequiplicata* | CAS254055 | KX671791 |
| | *Ptychadena* | cf. *aequiplicata* | CAS254056 | KX671792 |
| | *Ptychadena* | cf. *mascariensis* | CAS254083 | KX671785 |
| | *Ptychadena* | cf. *mascariensis* | CAS254084 | KX671786 |
| | *Ptychadena* | *oxyrhynchus* | CAS256820 | KX671787 |
| | *Ptychadena* | *oxyrhynchus* | CAS256862 | KX671788 |
| | *Scotobleps* | *gabonicus* | CAS254015 | KX671793 |
| | *Scotobleps* | *gabonicus* | CAS256676 | KX671794 |
| | *Scotobleps* | *gabonicus* | CAS256677 | KX671795 |
| | *Trichobatrachus* | *robustus* | CAS254082 | KX671802 |
| Squamata | *Agama* | *lebretoni* | CAS253879 | KX671720 |
| | *Cnemaspis* | *spinicollis* | CAS256886 | KX671729 |
| | *Dipsadoboa* | *duchesnii* | CAS254086 | KX671732 |
| | *Grayia* | *inornata* | CAS256859 | KX671733 |
| | *Hapsidophrys* | *smaragdinus* | CAS256860 | KX671734 |
| | *Hapsidophrys* | *smaragdinus* | CAS256861 | KX671735 |
| | *Panaspis* | *breviceps* | CAS256855 | KX671765 |
| | *Poromera* | *fordii* | CAS254085 | KX671784 |
| | *Trachylepis* | *affinis* | CAS256707 | KX671796 |
| | *Trachylepis* | *affinis* | CAS256856 | KX671797 |
| | *Trachylepis* | *affinis* | CAS256857 | KX671798 |
| | *Trachylepis* | *maculilabris* | CAS253881 | KX671799 |
| | *Trachylepis* | *maculilabris* | CAS253882 | KX671800 |
| | *Trachylepis* | *maculilabris* | CAS256792 | KX671801 |

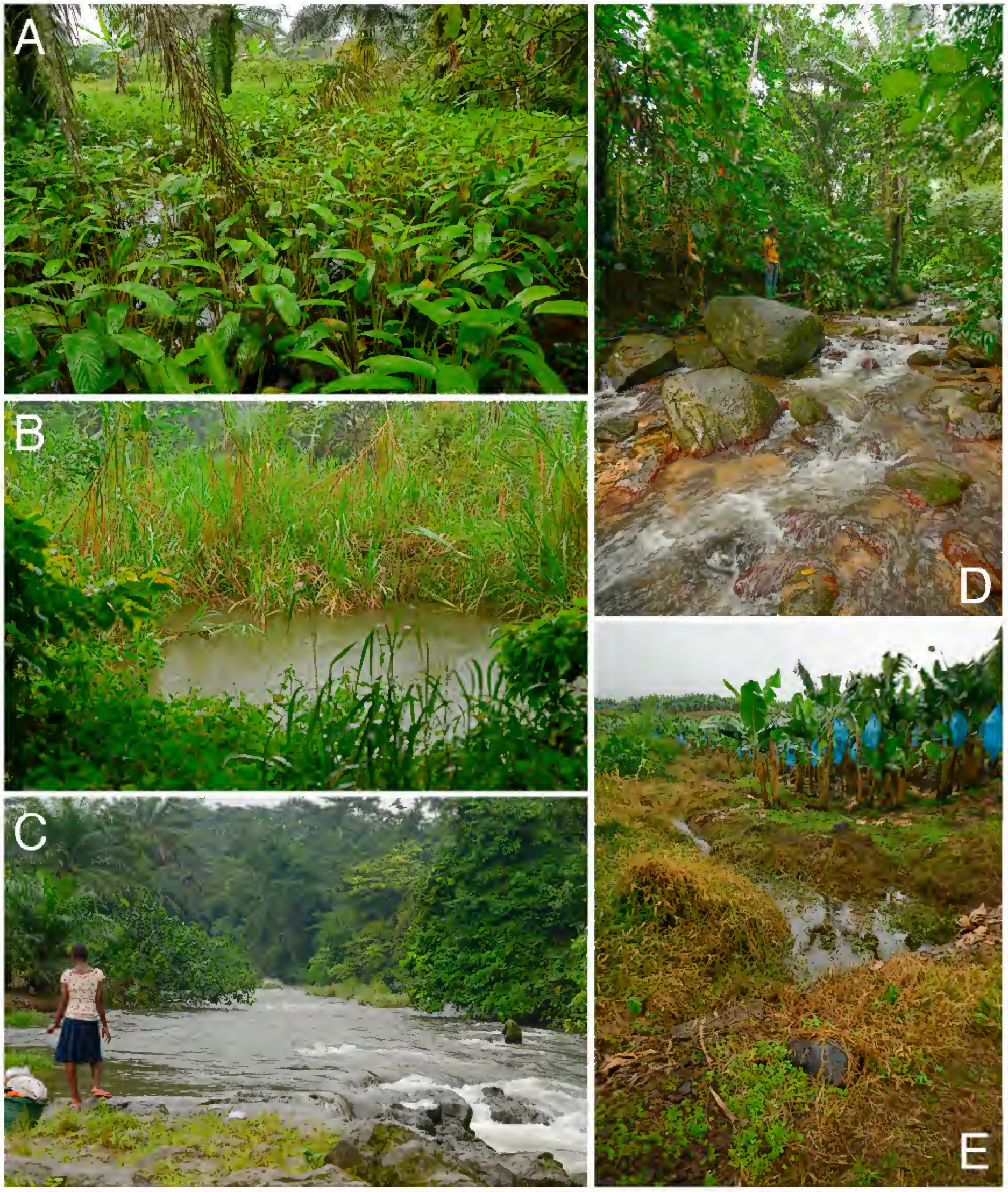


**Fig. 2.** Habitats surveyed during this fieldwork: (**A**) Main pond near plantation where a majority of hyperoliid species were caught; (**B**) fish ponds and associated vegetation next to large stream close to village; (**C**) large stream adjacent to fish ponds; (**D**) smaller streams located within secondary or primary forest; (**E**) disturbed habitat near plantation.

*Arthroleptis poecilonotus* is a common and widespread species, especially in degraded areas lacking closed canopy forest. The Central African populations ranging from Nigeria south to at least Republic of Congo represent a distinct species from populations in West Africa (west of Nigeria) that might represent one or more species (Rödel and Bangoura 2004; Blackburn et al. 2010; Jackson and Blackburn 2010). At higher elevations in the CVL, this species is often replaced by a morphologically similar but distantly related species, *A. palava* (Blackburn et al. 2010).

*Cardioglossa elegans* Boulenger, 1906. Figure 3C, D; 13 specimens. 4.8497°N, 9.7719°E (510 m): (2014)

CAS 256710. 4.8500°N, 9.7673°E (538 m): (2013) CAS 254064–65; (2014) CAS 256891, 256892–97, 256913–15. Females average 35.9 mm SUL (35.0–36.5 mm, *n* = 5) and males average 27.4 mm SUL (23.0–28.5 mm, *n* = 10). Individuals were caught on the ground or sitting on leaves (< 0.75 m high) adjacent to a small stream. Females were gravid. *Cardioglossa elegans* is widely distributed in forests below 1,000 m with records from on and near Mt. Kupe and nearby Mt. Nlonako (Amiet 1975, 1978; Hofer et al. 1999; Herrmann et al. 2005).

*Cardioglossa leucomystax* (Boulenger, 1903). Figure 3E; two specimens. 4.8406°N, 9.7793°E (491 m): (2014) CAS 256874. 4.8498°N, 9.7718°E (514 m): (2013) CAS 254080. Two males measure 27.0 and 28.0 mm SUL. Individuals were found on the high banks of a larger section of stream in secondary forest. While not recorded at sites around or above 900 m by Hofer et al. (1999), *C. leucoymystax* is well known from forested sites below 1,000 m in this region (Amiet 1975).

*Leptodactylodon ovatus* Andersson, 1903. Figure 3F; one specimen. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253933. Single male specimen measures 39.0 mm SUL. This individual was found moving across leaf litter between two permanent ponds during heavy rainfall. This specimen agrees with the description of *L. ovatus orientalis* provided by Amiet (1971, 1980) based on the rose coloration and more limited dark pigmentation on its venter. While *L. ovatus* is known from forested sites below 1,000 m in this region (Amiet 1975), the boundary between the two subspecies (*ovatus* and *orientalis*) is not clear. This newly collected specimen is along the western edge of the described distribution for *L. ovatus orientalis* (Amiet 1980).

*Leptopelis aubryi* (Duméril, 1865). Figure 3G; ten specimens. 4.8148°N, 9.7691°E (475 m): (2014) CAS 256685. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253969–73, 253976. 4.8247°N, 9.7702°E (494 m): (2013) CAS 253851–53. Females average 37.8 mm SUL (30.5–51.5 mm, *n* = 5) and males average 35.8 mm SUL (31.0–44.0 mm, *n* = 3). This small *Leptopelis* most closely resembles *Leptopelis aubryioides* and *L. modestus*, but lacks the heel spurs possessed by the former and lacks the white sub-ocular patch possessed by the latter (Amiet 2012). *Leptopelis aubryi* is found in lowland forests in southwestern and southern Cameroon (Amiet 2012), including near Manjo (Amiet 1975), and extends into mainland Equatorial Guinea, Gabon, and the Republic of Congo (Lasso et al. 2002; Burger et al. 2006; Jackson and Blackburn 2007; Pauwels and Rödel 2007).

*Leptopelis aubryioides* (Andersson, 1907). Figure 4A, B; eight specimens. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253974–75, 254053, 254061–63, 254088. 4.8560°N, 9.7480°E (1,010 m): (2014) CAS 256719. Females average 46.0 mm SUL (*n* = 2) and males average 32.8 mm SUL (31.0–35.0 mm, *n* = 4). This species is easily distinguished by the presence of heel spurs. *Leptopelis calcaratus* also has heel spurs; however, this species is larger (males 35–42 mm, females 46–57 mm; Schiøtz 1999) and has a conspicuous white sub-ocular patch (Amiet 2012). Among Cameroonian species of *Leptopelis*, *L. aubryioides* is one of the most frequently encountered lowland forest species (Amiet 2012).

*Leptopelis boulengeri* (Werner, 1898). Figure 4C, D; two specimens. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253980. 4.8560°N, 9.7480°E (1,010 m): (2014) CAS 256875. Female measures 70.5 mm SUL (CAS 256875). Both the brown and green phases of this species were found, which is identified by the presence of a conspicuous white spot (sub-ocular patch) below the eye and its large body size (males 37–48 mm, females 60–81 mm; Schiøtz 1999). The brown phase exhibits a dorsal triangle with apex pointed forward (Fig. 4C), and both phases often have black speckling on the flanks and a stripe between the eyes. *Leptopelis boulengeri* is distributed similarly to *L. aubryioides* and is frequently encountered in lowland forests of Cameroon (including near Manjo; Amiet 1975, 2012), mainland Equatorial Guinea (Lasso et al. 2002), Gabon (Burger et al. 2006; Pauwels and Rödel 2007), northern Republic of Congo (Capula et al. 2011), and may also extend west into southwestern Nigeria (Onadeko and Rödel 2009; Onadeko 2016).

*Leptopelis calcaratus* (Boulenger, 1906). Figure 3H; two specimens. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253981–82. Male specimen (CAS 253981) measures 34.0 mm SUL, female specimen (CAS 253982) measures 53.5 mm. *Leptopelis calcaratus* possesses heel spurs, white sub-ocular patches, and usually has black spots along its flanks. This forest species has a broad elevational range (Herrmann et al. 2005a; Amiet 2012) and, while not originally recorded near Manjo by Amiet (1975), is now known to occur widely in this region of Cameroon (Amiet 2012) and broadly across much of Central Africa and extending west into southwestern Nigeria (Onadeko 2016).

*Leptopelis rufus* Reichnow, 1874. Figure 4E, F; 31 specimens. 4.8148°N, 9.7691°E (475 m): (2014) CAS 256680–84. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253968, 254042–52. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256823. 4.8560°N, 9.7480°E (1,010 m): (2014) CAS 256717–18, 256806–08, 256876–83. Females average 76.7 mm SUL (67.0–84.0 mm, *n* = 9) and males average 50.2 mm SUL (39.0–57.0 mm, *n* = 19). This species is identified by its large size (males 45–55 mm, females 74–87 mm; Schiøtz 1999), and is distinguishable from *L. boulengeri* by having dark transverse bars on the dorsum and the absence of a white eye spot. *Leptopelis rufus* is distinguishable from *L. millsoni* by its

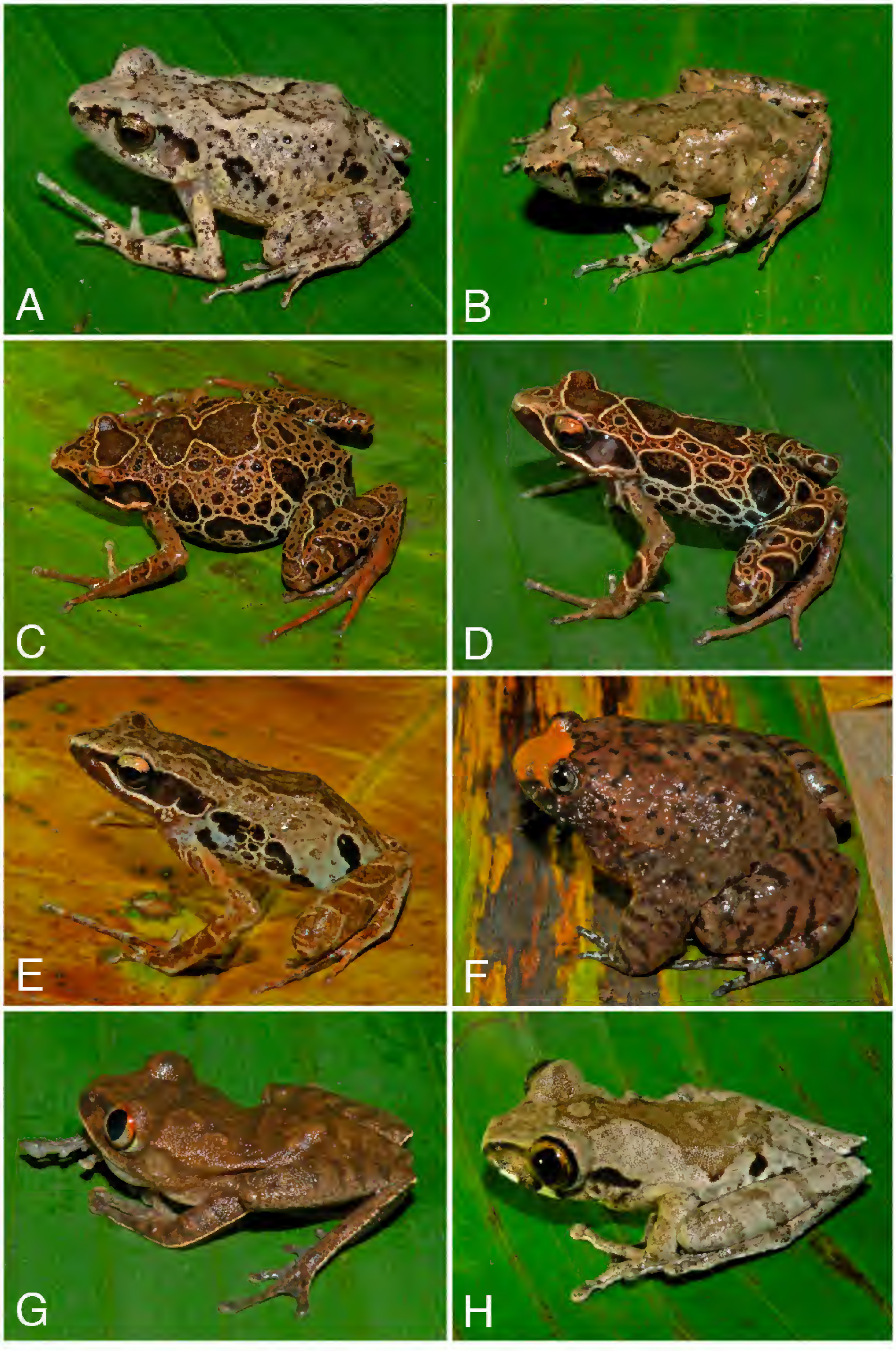


**Fig. 3.** Representatives of arthroleptid frog taxa. (**A**) *Arthroleptis poecilonotus*, male (CAS 256711); (**B**) *Arthroleptis poecilonotus* (CAS 254036); (**C**) *Cardioglossa elegans*, female (CAS 256893); (**D**) *Cardioglossa elegans*, male (CAS 256710); (**E**) *Cardioglossa leucomystax*, male (CAS 254080); (**F**) *Leptodactylodon ovatus* (CAS 253933); (**G**) *Leptopelis aubryi* (CAS 253852); (**H**) *Leptopelis calcaratus* (CAS 253981).

smaller tympanum and pectoral glands in males and by their much larger size for females. Specimens were often collected from tree branches overhanging swiftly moving streams, where males were heard calling. It is frequently encountered in the lowland forests of Cameroon and Gabon up to ~1,000 m, though it is not typically encountered above 1,100 m (Amiet 1975, 2012; Herrmann et al. 2005a; Burger al. 2006; Pauwels and Rödel 2007), and is known from Mt. Kupe (Amiet 1975; Schmitz et al. 1999).

*Nyctibates corrugatus* Boulenger, 1904. Figure 4G; one specimen. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256829. Female measures 55.0 mm SUL, and was gravid. *Nyctibates corrugatus* is a common species at lower elevations in the forests of southwestern Cameroon (Amiet 1973, 1975, 1978; Lawson 1993; Herrmann et al. 2005a) and extending into mainland Equatorial Guinea (Lasso et al. 2002). This specimen was collected 20 meters inland from the large stream illustrated in Fig. 2C, in an agricultural plot of cocoa.

*Scotobleps gabonicus* Boulenger, 1900. Figure 4H; 19 specimens. 4.8148°N, 9.7691°E (475 m): (2014) CAS 256676–79. 4.8406°N, 9.7793°E (491 m): (2014) CAS 256863–67. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256709. 4.8498°N, 9.7718°E (513 m): (2013) CAS 254015–22. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256828. Confirmed males average 35.6 mm SUL (23.5–44.0 mm, $n$ = 7) and confirmed female specimen is 63.5 mm SUL. Specimens were generally collected in the leaf litter adjacent to smaller streams, in semi-disturbed habitat. The range of *S. gabonicus* extends from western Nigeria, through Cameroon, and south through mainland Equatorial Guinea, Gabon, and into the forested coastal region of Democratic Republic of Congo (Laurent 1961; Amiet 1975, 1978; Lasso et al. 2002; Burger et al. 2006; Pauwels and Rödel 2007). Like *Cardioglossa elegans*, *S. gabonicus* is common in the littoral plain at low elevations in southwestern Cameroon (Amiet 1975, 1983).

*Trichobatrachus robustus* Boulenger, 1900. Figure 5A–C; six specimens. 4.8339°N, 9.7783°E (490 m): (2013) CAS 254069–70. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253934, 254082. 4.8506°N, 9.7671°E (541 m): (2014) CAS 256884–85. Females average 79.5 mm SUL (74.0 and 85.0 mm, $n$ = 2) and males average 78.5 mm SUL (72.5–90.0 mm, $n$ = 3). Specimens were collected in close proximity to swiftly moving streams in secondary forest (Fig. 2D), but were also collected away from the streams in burrows or moving during rainstorms. All males that we collected exhibited developed "hairs" on the legs and flanks. *Trichobatrachus robustus* is found in the coastal Atlantic forests extending from Nigeria south to northern Angola (Amiet 1978; Ernst et al. 2014) and is known from low elevations both on and near Mt. Kupe (Amiet 1975; Euskirchen et al. 1999; Hofer et al. 1999).

## Bufonidae

*Sclerophrys regularis* (Reuss, 1833). Three specimens. 4.8406°N, 9.7793°E (491 m): (2014) CAS 256712–13. 4.8498°N, 9.7718°E (513 m): (2013) CAS 254023. Male specimens are 51.5 mm and 55.0 mm SUL (CAS 256713, 254023) and female is 66.5 mm SUL (CAS 256712). Specimens were abundant in the most disturbed habitat sampled (Fig. 2E), and were calling from puddles on the main dirt road through a banana plantation.

*Sclerophrys superciliaris* (Boulenger, 1888). 4.8500°N, 9.7673°E: (2014) photo voucher MVZObs:Herp:20 (Fig. 5F). We found and photographed a large individual corresponding to the subspecies *S. superciliaris superciliaris* (Barej et al. 2011) perched on a large boulder under a stand of bamboo that was adjacent to a swiftly moving stream in secondary forest. This uncommon forest species generally occurs at low elevations from Nigeria to Gabon (Barej et al. 2011). Previously found on Mt. Nlonako (Herrmann et al. 2005a) and just to the northwest of Mt. Kupe at Meked (Barej et al. 2011), we believe this to be the first definitive record on Mt. Kupe.

## Conrauidae

*Conraua goliath* (Boulenger, 1906). Figure 5D; single specimen. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256830. A juvenile specimen (measuring 51.5 mm SUL) was collected on the bank of the large stream in Fig. 2C. This specimen was identified in the field as *C. robusta* but DNA sequence data reveals that it is a juvenile *C. goliath*. Larger adults were spotted in large and more slowly moving streams during surveys but not collected. The largest adult encountered was spotted at night in a culvert directly next to the highway where locals often washed clothing. *Conraua goliath* is currently the only anuran species afforded special protection by the Republic of Cameroon, largely due to hunting of this species for human consumption.

*Conraua robusta* Nieden, 1908. Figure 5E; two specimens. 4.8506°N, 9.7671°E (541 m): (2014) CAS 256822. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256821. Juvenile specimen (CAS 256821) is 56.5 mm SUL and unsexed adult (CAS 256822) is 130.0 mm SUL. *Conraua robusta* occurs along fast-moving streams along a broad elevational gradient (up to ~1,850 m) and has long been known from southwestern Cameroon (Amiet 1978), including near Nkongsamba and on Mt. Kupe (Lamotte and Perret 1968; Amiet 1975, 1983; Euskirchen et al. 1999). The juvenile specimen was collected from a large boulder within the stream in Fig. 2C, whereas the adult was found in a small section of stream near its confluence with a larger stream in the secondary forest illustrated in Fig. 2D. Additional specimens were observed in this stream but were not captured.

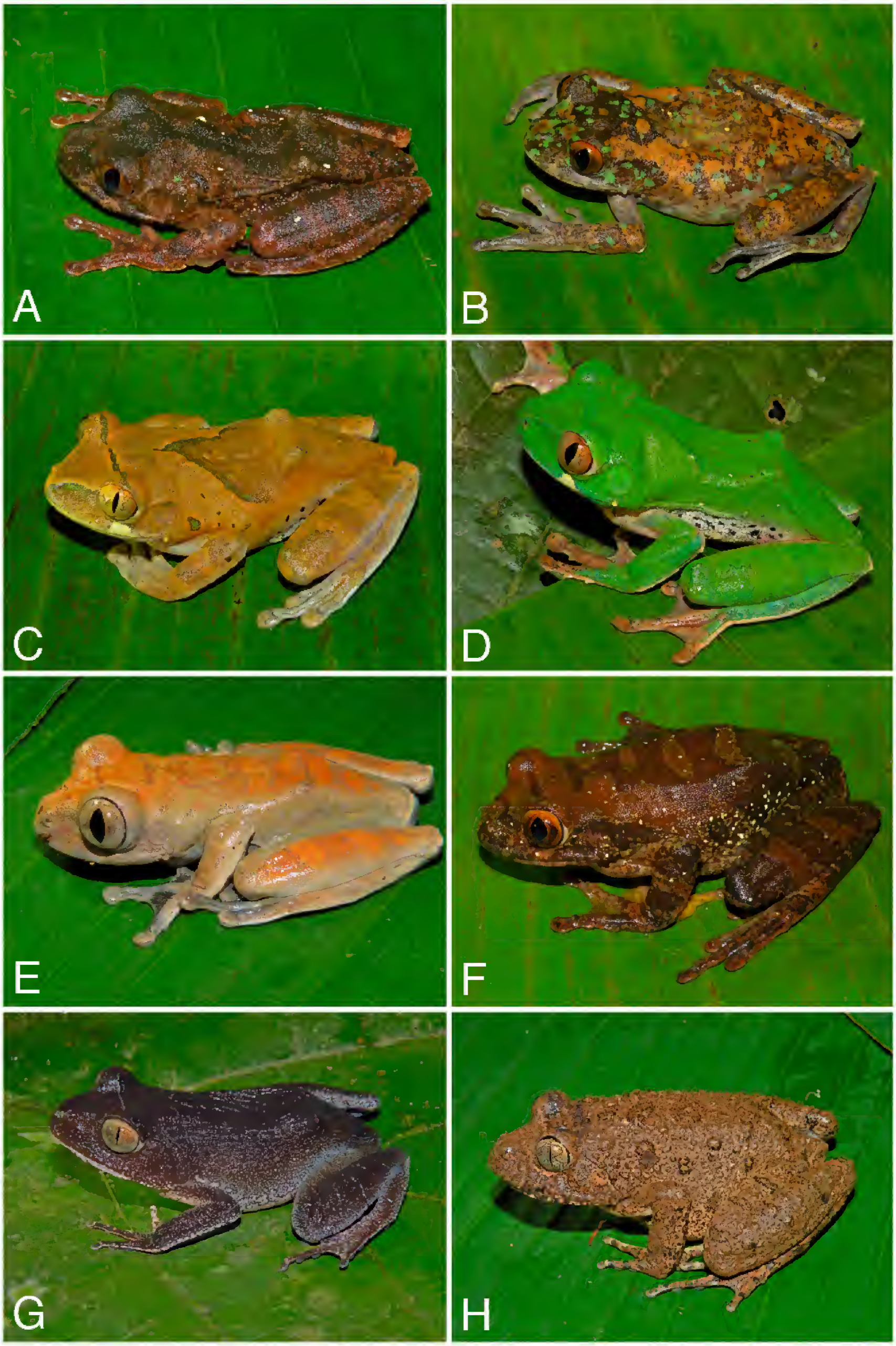


**Fig. 4.** Representatives of arthroleptid frog taxa. (**A**) *Leptopelis aubryioides* (CAS 256719); (**B**) *Leptopelis aubryioides*, female (CAS 254061); (**C**) *Leptopelis boulengeri* (CAS 253980); (**D**) *Leptopelis boulengeri* (CAS 256875); (**E**) *Leptopelis rufus* (CAS 256684); (**F**) *Leptopelis rufus* (CAS 254046); (**G**) *Nyctibates corrugatus* (CAS 256829); (**H**) *Scotobleps gabonicus* (CAS 256678).

## Hyperoliidae

For this family our discussion of color patterns follows usage of the terminology of Schiøtz (1999), which includes Phase J and Phase F. Phase J describes the juvenile coloration, which is also typical of a majority of adult males. Phase F describes the color pattern of adult females, and in some species this can also occur in subset of adult males. All females begin with Phase J coloration and transition to Phase F coloration, whereas males can either retain Phase J coloration or transition to Phase F upon maturity. Here, we also report evidence for adult males transitioning between these color phases, a phenomenon that has received little, if any, attention in the literature. When possible, we quantify the percentage of the adult males sampled in the population that exhibit Phase J vs. Phase F coloration, as hyperoliid species vary greatly in the composition of color morphs (DMP, pers. obs.).

*Afrixalus dorsalis* (Peters, 1875). Figure 5G, H, and Fig. 6A; 29 specimens. 4.8148°N, 9.7691°E (475 m): (2014) CAS 256690–92. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256747–49, 256819. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253955–61, 253965. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256842. 4.8247°N, 9.7702°E (494 m): (2013) CAS 253854–66. Females average 26.5 mm SUL (24.0–28.5 mm, $n$ = 4) and males average 25.4 mm SUL (17.0–28.5 mm, $n$ = 22). This species is superficially similar to *Afrixalus paradorsalis* with regard to color pattern, but can be distinguished by the smaller body size of each sex. This lowland species was most abundant in heavily disturbed habitat (ditches next to main highway), but was also found in disturbed habitats close to secondary forest. Amiet (1975, 2012) recorded *A. dorsalis* from Nlohé at the southeastern extent of Mt. Kupe.

*Afrixalus laevis* (Ahl, 1930). Figure 6B–D; four specimens. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253946, 254071–73. Female is 24.0 mm SUL and males average 20.2 mm SUL (19.5–21.0 mm, $n$ = 3). Specimens were found on the leaves of trees or palms (1–3 m high) overhanging a small slowly moving stream. Though previously emphasized by Amiet (2012), we also observed stark differences in the coloration of individuals during periods of nocturnal activity and inactivity during the day. These differences are illustrated in the individuals photographed at night after capture (Fig. 6A) and the following morning (Fig. 6C, D). *Afrixalus laevis* is a widespread forest species previously recorded on both Mt. Manengouba (Amiet 2012) and Mt. Kupe (Hofer et al. 1999).

*Afrixalus paradorsalis* Perret, 1960. Figure 6E, F; 25 specimens. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256750–59, 256911–12. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253947–54, 253962–64, 253966–67. Females average 33.3 mm SUL (31.0–36.0 mm, $n$ = 5) and males average 30.4 mm SUL (29.0–32.0 mm, $n$ = 19). Superficially similar to *A. dorsalis*, but distinguished by the larger body size of each sex. Based on their dorsal patterning, our records resemble *A. paradorsalis paradorsalis* (Amiet 2012). We observed this widespread lowland species breeding in permanent ponds (Fig. 2A) or adjacent flooded grassy areas. Because of its frequent confusion with *A. dorsalis* and *A. equatorialis*, the extent of distribution of *A. paradorsalis* is not quite clear, but it likely extends south into Equatorial Guinea and Gabon (Lasso et al. 2002; Burger et al. 2006).

*Hyperolius bolifambae* Mertens, 1938. Figure 6G, H; 45 specimens. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256737–46, 256817–18, 256907–08. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253883–912, 253977. Females average 30.7 mm SUL (28.5–33.5 mm, $n$ = 13) and males average 24.8 mm SUL (23.0–26.5 mm, $n$ = 32). This species occurred in high abundance at the permanent ponds (Fig. 2A), and is easily distinguished from all other sympatric *Hyperolius* species by the presence of a heel spot. This species is sexually dichromatic, with females (Fig. 6H) having bright red finger and toe tips, a darker flank, a more vividly colored dorsum, and a conspicuous ventral pattern with prominent white spots on a black background. Males (Fig. 6G) sometimes display the ventral spotted pattern, but never exhibit the black background observed in the females. Rather, this coloration ranges from whitish to dark grey. *Hyperolius bolifambae* is common at low elevations in southwestern Cameroon as well as in far eastern Cameroon, though it is rare in between (Amiet 2012). Amiet (1975) recorded *H. bolifambae* from the nearby sites of Lala and Nhalé, as well as Maholé to the west of Mt. Kupe (Amiet 2012).

*Hyperolius camerunensis* Amiet, 2004. Figure 7A–D; 19 specimens. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256729–31, 256916. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253935, 253936–43, 254040–41, 254059–60, 254078–79. Females average 29.0 mm SUL (24.5–32.5 mm, $n$ = 6) and males average 23.2 mm SUL (19.0–25.0 mm, $n$ = 13). This is a sexually dichromatic species. Males resemble the pattern of male *H. ocellatus* by having pale dorsolateral stripes on a green background that is sometimes speckled with a reddish coloration (Fig. 7A, C), but they never display the pale triangle on the nose that characterizes male *H. ocellatus* (see *H. ocellatus* males in Fig. 9A, C). Females have a brownish-tan dorsum that varies in the amount of red patterning outlined by black and yellow, bright yellow ventral coloration, and bright red on the thighs, fingers, toes, and webbing (Fig. 7B, D). All specimens were found at shallow ponds. Of the 13 males collected, a single male was found that exhibited the typical female coloration (CAS 256916), yielding a frequency of 7% for Phase F males. While recorded on both Mt. Nlanoko and Mt. Manengouba (Her-

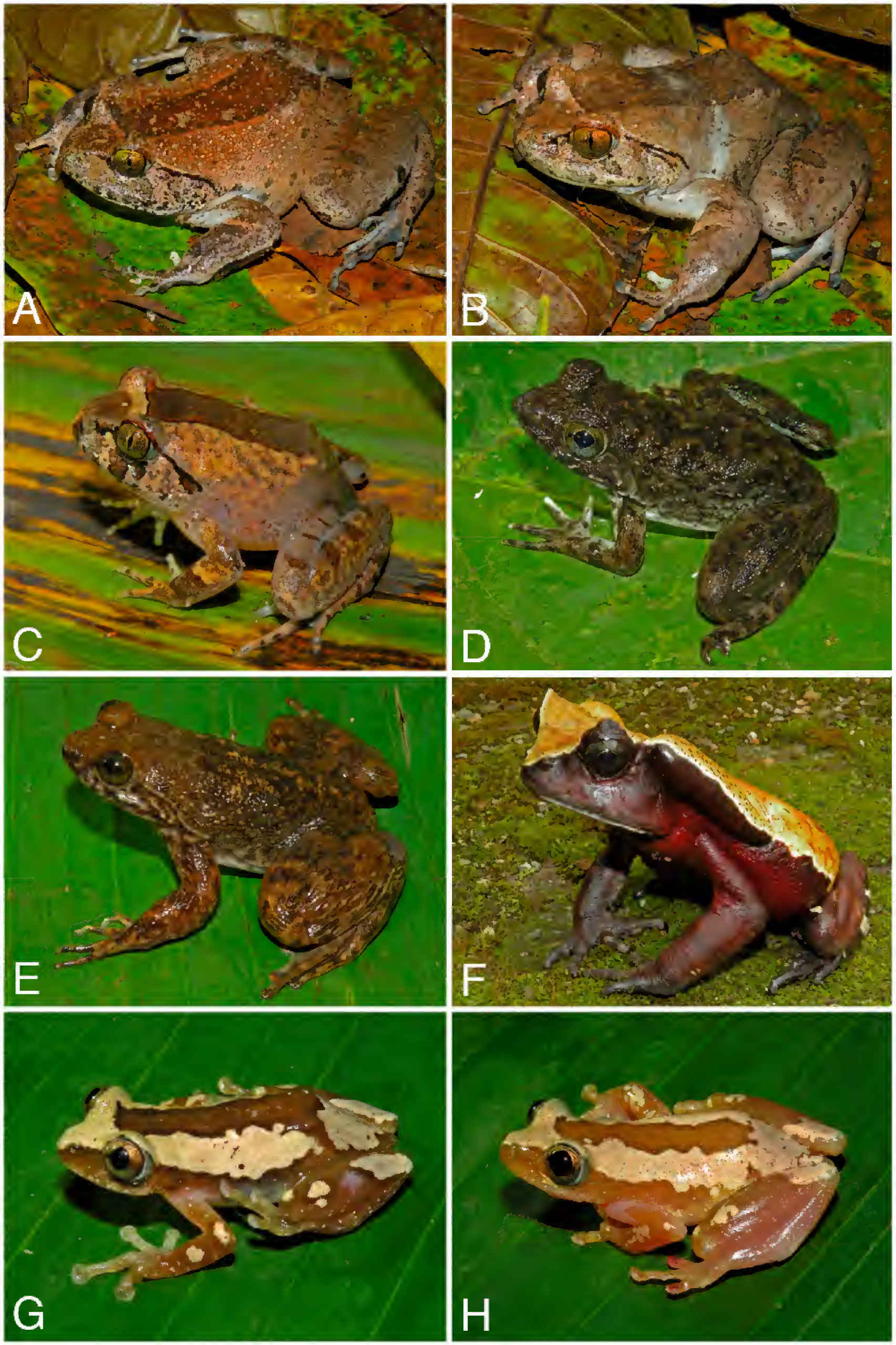


**Fig. 5.** Representatives of arthroleptid, conrauid, bufonid, and hyperoliid frog taxa. (**A**) *Trichobatrachus robustus*, female (CAS 254069); (**B**) *Trichobatrachus robustus*, male (CAS 254070); (**C**) *Trichobatrachus robustus*, juvenile (CAS 253934); (**D**) *Conraua goliath*, juvenile (CAS 256830); (**E**) *Conraua robusta*, juvenile (CAS 256821); (**F**) *Sclerophrys superciliaris* (photo voucher); (**G**) *Afrixalus doralis*, female (CAS 256690); (**H**) *Afrixalus doralis*, male (CAS 256691).

rmann et al. 2005; Amiet 2012), this appears to be the first record for *H. camerunensis* at Mt. Kupe, and it is approaching the southwestern extent of its range (Amiet 2012).

*Hyperolius concolor* (Hallowell, 1844). Figure 7E–H; 63 specimens. 4.8148°N, 9.7691°E (475 m): (2014) CAS 256694–95. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256793–805, 256898–902, 256917–19. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253913–32. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256843–54. 4.8247°N, 9.7702°E (494 m): (2013) CAS 253868–75. Females average 36.4 mm SUL (33.0–40.0 mm, $n$ = 13) and males average 28.3 mm SUL (24.5–33.5 mm, $n$ = 46). This is a sexually dichromatic species. Females have a bright green dorsum, with yellow flanks and ventrum, and red coloration occurs on the inside of the thighs and covers the webbing, and sometimes discs, of the fingers and toes (Fig. 7F). Males are generally dark to light brown with patterning often involving a triangle between the eyes with apex pointed backwards, with some amount of banding or spots posteriorly (Fig. 7E). A Phase F male is present, which is mainly green with some yellow ventrally, but it does not exhibit any red coloration on the thighs, or webbing or discs of the fingers and toes (Fig. 7G). Of the 48 males collected, 11 were found with the typical female coloration and two were in transition between color morphs (Fig. 7H), yielding a frequency of 27% for the Phase F male. This species was most abundant in the grass-filled ditches of the banana plantation (Fig. 2E; Amiet 2012), but some were collected at the ponds. This lowland species is found in southwestern Cameroon and was previously recorded at nearby Nhalé (Amiet 1975).

*Hyperolius dintelmanni* (Lötters and Schmitz, 2004). Figure 8A–C; 4 specimens. 4.8148°N, 9.7691°E (475 m): (2014) CAS 256693. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253991. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256840–41. Female measures 35.5 mm SUL and males average 32.2 mm SUL (32.0–32.5 mm, $n$ = 3). This is a sexually dichromatic species. Phase J males resemble the coloration of typical *H. tuberculatus* (Fig. 8A), though often with brighter green or yellow markings on the dorsum, whereas females exhibit fine reddish-pink points on a greyish-tan background, with a pinkish-red ventral coloration (Fig. 8B). The Phase F male displays a smaller number of reddish-pink points on the dorsum, and bright reddish-pink coloration ventrally (Fig. 8C). Of the three males collected, only one exhibited the Phase F coloration (Fig. 8C), yielding a frequency of 33%, though our sample size is very small. The female phase described for *H. dintelmanni* by Lötters and Schmitz (2004) was not found at Mt. Kupe, and they do not mention the Phase F we describe here. Our measurements of males match those provided by Lötters and Schmitz (2004), but the female is substantially larger (35.5 mm) than the described body size range for females (27.3–29.8 mm). This species was collected mainly at the fish ponds, but one male was found at the larger permanent ponds. Treated as a subspecies of *H. tuberculatus* (Mocquard, 1897) by Amiet (2012), genetic analyses have revealed that *H. dintelmanni* is a distinct lineage that is sister to *H. tuberculatus* (Portik 2015; Bell et al., in prep). Previously recorded from the nearby Bakossi Mountains, this is the first record of *H. dintelmanni* from Mt. Kupe and at a much lower elevation (475–560 m) than previously recorded (1,100–1,250 m; Lötters and Schmitz 2004; Amiet 2012).

During July 17–18, 2013, DMP, GFMJ, and MTK conducted additional survey work at the type locality for this species (Edib, Cameroon: 4°57.578 N, 9°39.146 E, ~1,140 m elevation). Here, a series of 16 specimens of *H. dintelmanni* were collected (three females, 13 males; CAS 254135–37, 254156–68) matching the Phase J and Phase F we have described for Mt. Kupe. Based on this series, we also did not find any specimens that match the females described by Lötters and Schmitz (2004). All of the specimens from Edib are confirmed as genetically identical to those collected at Mt. Kupe (Portik 2015; Bell et al., in prep). The females collected at Edib are also larger (31.3, 31.8, and 33.8 mm) than the body size range described for the females described by Lötters and Schmitz (2004) (27.3–29.8 mm). The range of the body size for males we collected ($n$ = 13, 29.6–32.5 mm, average = 31.0 mm) matches the range described for this species (29.5–33.8 mm), and the Phase J coloration of these males is consistent. However, the Phase F males collected at Edib match the Phase F coloration we describe for Mt. Kupe. The original description for the Phase F presented by Lötters and Schmitz (2004) is not typical for *H. tuberculatus* or any of its close relatives (*H. viridiflavus* and *H. marmoratus* complexes), but this coloration is characteristic of a clade recovered by Portik (2015) consisting of *H. bolifambae*, *H. camerunensis*, *H. ocellatus*, *H. riggenbachi*, and the *Hyperolius* sp. presented below. In these species, the females often have bright red coloration on the thighs, fingers, and toes, yellow ventral coloration, and complex patterning on the dorsum, which is qualitatively very similar to the description and photo presented by Lötters and Schmitz (2004).

Hyperoliids are notoriously difficult to identify due to a conserved morphology and color variation resulting from sexual dichromatism, but DNA barcoding is a robust method for assigning species identifications. We have collected a large series of *H. dintelmanni* from two localities (including the type locality), confirmed identifications through DNA barcoding, and found a consistent Phase F that differs from the original description. Lötters and Schmitz (2004) did not generate 16S data for the type series of *H. dintelmanni*, and assumed because the male and female specimens were collected in close proximity they constitute a single species. Based on all the evidence presented, we propose that the females described by Lötters and Schmitz (2004) are misidentified, and are

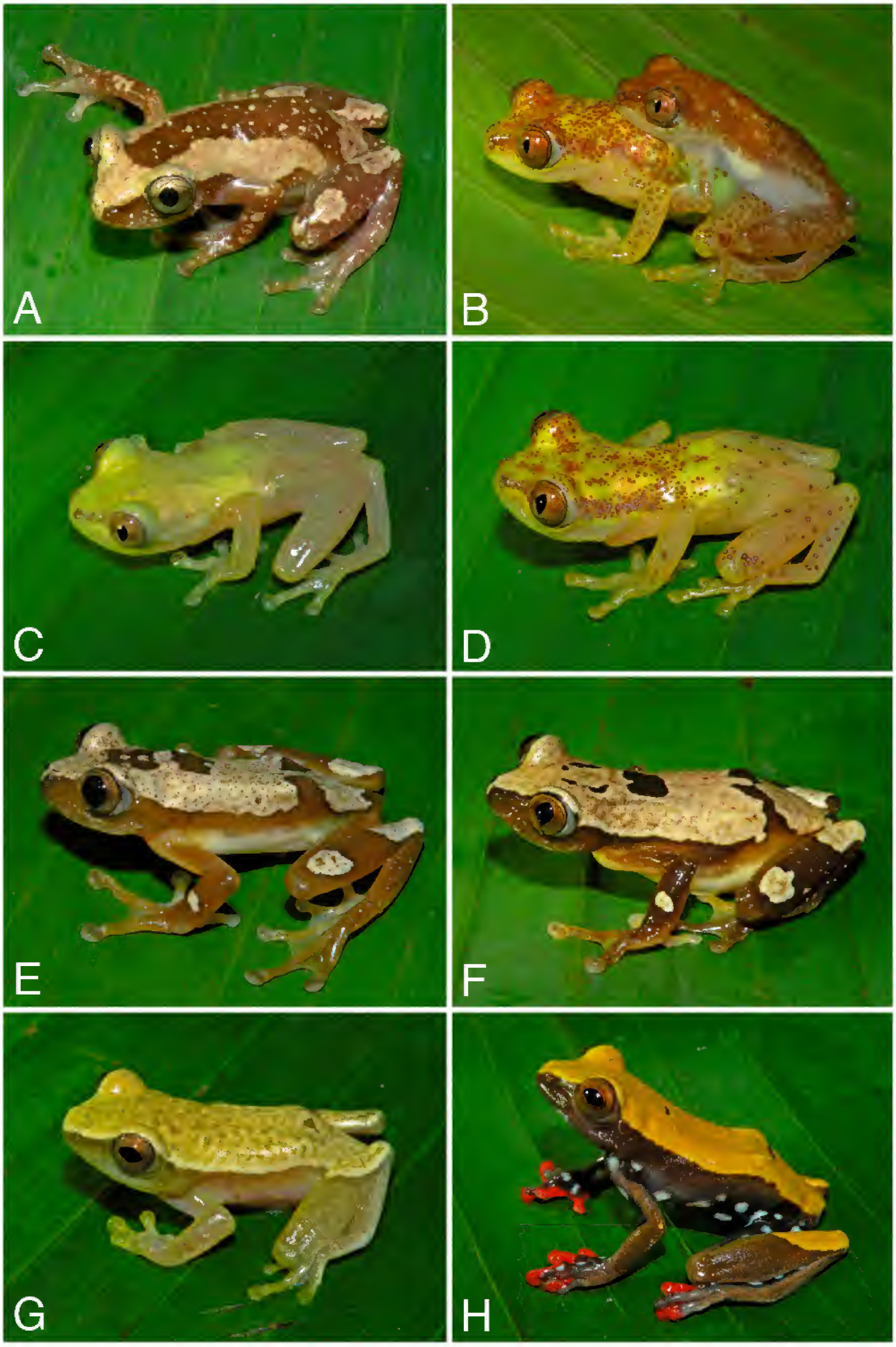


**Fig. 6.** Representatives of hyperoliid frog taxa. (**A**) *Afrixalus doralis*, male (CAS 253854); (**B**) *Afrixalus laevis*, amplexus, night coloration (CAS 254072–3); (**C**) *Afrixalus laevis*, male, day coloration (CAS 254073); (**D**) *Afrixalus laevis*, female, day coloration (CAS 254072); (**E**) *Afrixalus paradoralis*, male (CAS 253954); (**F**) *Afrixalus paradoralis*, female (CAS 253953); (**G**) *Hyperolius bolifambae*, male (CAS 256743); (**H**) *Hyperolius bolifambae*, female (CAS 256745).

probably referable to the clade consisting of *H. bolifambae*, *H. camerunensis*, *H. ocellatus*, *H. riggenbachi*, and *Hyperolius* sp. We propose the following alternative hypotheses to explain the females described by Lötters and Schmitz (2004): 1) they represent a more variable Phase F form of *H. camerunensis*, *H. ocellatus*, or *H. riggenbachi*, though this is very doubtful, 2) they represent the females of *Hyperolius* sp., for which we were unable to collect females at Mt. Kupe, or 3) they represent an additional candidate species in this clade. Given *H. dintelmanni* has been found at both sites, other *Hyperolius* occurring at Mt. Kupe may also have a similar geographic distribution, including *Hyperolius* sp. Given the qualities of color patterns in the *H. viridiflavus/marmoratus* group, it is extremely unlikely the odd females at Edib represent an additional Phase F of *H. dintelmanni*. Additional survey work, coupled with DNA barcoding, will determine which species these females belong to. The holotype of *H. dintelmanni* is a Phase J male that is consistent with males we collected, and we therefore maintain usage of this species name for the lineage we have collected at Mt. Kupe and Edib.

*Hyperolius fusciventris* Peters, 1876. Figure 8E–H; 81 specimens. 4.8148°N, 9.7691°E (475 m): (2014) CAS 256696–700. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256720–24, 256760–91, 256811–15, 256903. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253992–4004, 254005–14, 254087. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256831–37. 4.8247°N, 9.7702°E (494 m): (2013) CAS 253876–77. Females average 25.5 mm SUL (23.5–29.0 mm, $n$ = 13) and males average 19.9 mm SUL (17.0–22.0 mm, $n$ = 65). This is a sexually dichromatic species. Males are quite variable in coloration, ranging from plain green background with narrow pale dorsolateral strips starting behind the eye, to a green background heavily speckled with brownish-black and broad yellow dorsolateral stripes (Fig. 8E, G). Females have a green dorsum with flanks with red, white, and sometimes yellow vermiculations (Fig. 8E, F). These vermiculations often continue to the canthus rostralis, and ventrum is uniform reddish-white. A Phase F male is present, which is similar to the female form except in having no coloration on the hands, feet, and thighs. Of the 65 males collected, one exhibited the typical female coloration (Fig. 8H), yielding a frequency of 1.5% for the Phase F male. *Hyperolius fusciventris* is a lowland species complex extending across West Africa with its eastern extent in southwestern Cameroon (Amiet 2012). There are currently three described subspecies, including *H. f. fusciventris*, *H. f. lamtoensis*, and *H. f. burtoni*, which occupy broad but allopatric regions of Upper Guinea (Sierra Leone to westernmost Côte d'Ivoire, Côte d'Ivoire, and Ghana to Nigeria, respectively), that are distinguishable on the basis of female coloration. The form in Cameroon is actually regarded as an undescribed subspecies in this complex, *H. f.* spp. (Schiøtz 1999). The Cameroonian females are distinguished by having a uniform reddish-white ventrum, in contrast to the females of *H. f. burtoni* (occurring in Nigeria), which are reported to have a white ventrum with irregular black spots. Further molecular and morphological work is required to clarify the taxonomic status of this species complex, including the affinities of the Cameroonian populations.

*Hyperolius ocellatus* Günther, 1858. Figure 9A–D; 20 specimens. 4.8148°N, 9.7691°E (475 m): (2014) CAS 256701–06. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256725–28, 256909–10. 4.8498°N, 9.7718°E (513 m): (2013) CAS 254057–58, 254074–77. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256838–39. Females average 30.2 mm SUL (27.5–32.0 mm, $n$ = 9) and males average 25.5 mm SUL (21.0–32.5 mm, $n$ = 11). This is a sexually dichromatic species. The male dorsum is green, sometimes with red suffusion, and a conspicuous pale yellow triangle is present on the nose along with dorsolateral stripes (Fig. 9A, C). The females have a complex color pattern. The dorsum is gray to brown with lightly outlined fine black spots, and the flanks exhibit a white background with large black vermiculations (Fig. 9A, B, D). The thighs, fingers, and toes are bright red, and the ventrum is bright yellow. No Phase F males have ever been recorded for this species across its range, which extends throughout western and southern Cameroon through mainland Equatorial Guinea and Gabon (Lasso et al. 2002; Burger et al. 2006; Amiet 2012). While previously known from this region of Cameroon (Herrmann et al. 2005; Amiet 2012), we believe this is the first record on Mt. Kupe. Amiet (2012) described distinct color patterns in females that correspond to allopatric regions, but this variation was not assigned to distinct subspecies. Molecular work is currently underway to investigate the evolutionary relationships of populations of *H. ocellatus* from throughout the known range (Bell et al., in prep).

*Hyperolius* sp. Figure 8D; 11 specimens. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256732–36, 256816, 256904–06; 4.8498°N, 9.7718°E (513 m): (2013) CAS 253944–45. We only found males, which averaged 27.5 mm SUL (26.0–29.5 mm, $n$ = 11). This species is quite similar in coloration to males of *H. camerunensis* (Fig. 7A, C), the species to which we first attributed it in the field. However, this undescribed species is larger and non-overlapping in size (average 27.5 mm, range 26.0–29.5 mm) when compared to *H. camerunensis* (average 23.2 mm, range 19.0–25.0 mm), and also has a distinctive red suffusion on the ventrum. This species overlaps with *H. riggenbachi* in male body size (average 28.1, 25.5–30.8, $n$ = 39; Portik 2015), is very similar in coloration, and exceptionally difficult to distinguish. Based on genetic data, it apparently occurs in direct sympatry with *H. riggenbachi* in Bangoua (5.1763°N, 10.3487°E) (Por-

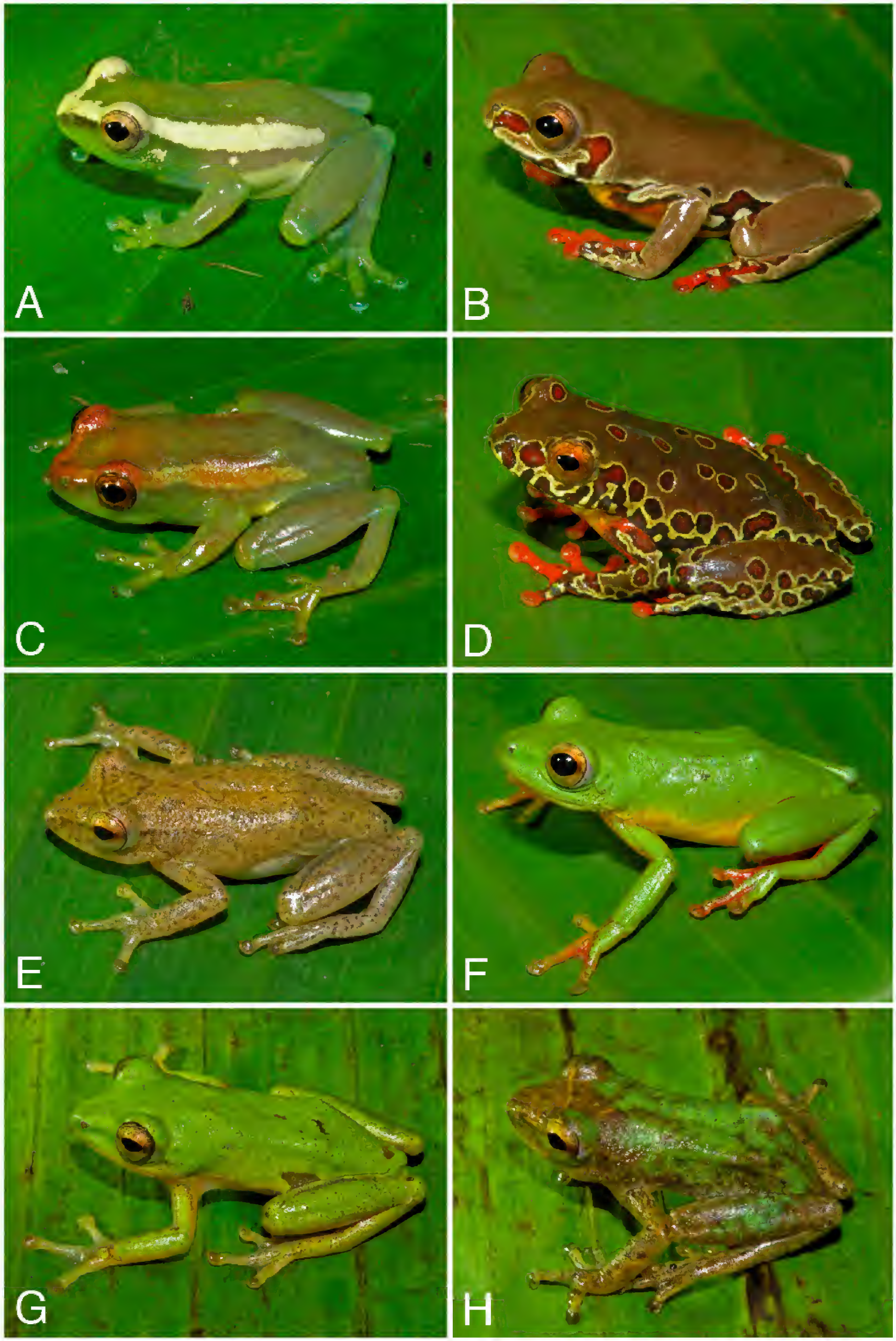


**Fig. 7.** Representatives of hyperoliid frog taxa. (**A**) *Hyperolius camerunensis*, male (CAS 253939); (**B**) *Hyperolius camerunensis*, female (CAS 253935); (**C**) *Hyperolius camerunensis*, male (CAS 253938); (**D**) *Hyperolius camerunensis*, female (CAS 255486); (**E**) *Hyperolius concolor*, male (CAS 253873); (**F**) *Hyperolius concolor*, female (CAS 253928); (**G**) *Hyperolius concolor*, phase F male (CAS 256898); (**H**) *Hyperolius concolor*, transitional male (CAS 256844).

tik, unpubl. data). Further morphological and molecular work is underway to identify this currently undescribed species (Portik et al., in prep).

*Kassina decorata* (Angel, 1940). Figure 9E; one specimen. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253990. This single female specimen (39.0 mm SUL) was collected near a flooded marsh at the edge of a plantation. Amiet (2007, 2012) discussed the considerable confusion as to whether *K. decorata* is distinct from *K. maculosa* (Sternfeld, 1917). This specimen is phenotypically similar to Amiet's (2007, 2012) description of *K. decorata* with the dorsal spots coalesced into a single longitudinal band as well as a supratympanic band extending posteroventrally around the tympanum (Fig. 9E). While the type locality in the caldera of Mt. Manengouba is approximately 1,950 m, Amiet (2007) reports specimens from Santchou at 700 m. This specimen from near Manjo is nearly genetically identical to specimens collected in the caldera of Mt. Manengouba (Portik, unpubl. data) and supports Amiet's (2007) conclusion that phenotypically distinct populations of *K. decorata* occur across a broad elevational range.

*Phlyctimantis leonardi* (Boulenger, 1906). Figure 9F; two specimens. 4.8498°N, 9.7718°E (513 m): (2013) CAS 253978–79. Two male specimens measure 45.0 and 46.0 mm SUL. Both males were found calling in the permanent ponds. Amiet (2007) records *Phlyctimantis* from this region of Cameroon though the identity of Cameroonian populations remains unclear because the distinction between *P. leondardi* and *P. boulengeri* (Perret 1986) remains confusing (Amiet 2007, 2012; Gvoždík and Kopecký 2012). In the two specimens from Manjo, the skin is smooth with some finely colored tubercles, resembling an intermediate form between *P. leonardi* and *P. boulengeri* (Amiet 2012). Recent genetic data demonstrate that these specimens of *Phlyctimantis* are more closely related to *P. leonardi* of Gabon than they are to *P. boulengeri* of Ghana (Portik 2015). We therefore attribute this Cameroonian population to *P. leonardi*, but acknowledge that both species might occur in Cameroon.

## Petropedetidae

*Petropedetes cameronensis* Reichenow, 1874. Figure 9G; four specimens. 4.8500°N, 9.7673°E (538 m): (2014) CAS 256887–90. A gravid female measures 42.0 mm SUL (CAS 256887), and other unsexed specimens in the series measure 41.0 mm, 23.0 mm, and 23.5 mm SUL, respectively. Specimens were found on a small island surrounded by a fast flowing stream, alongside *Cardioglossa elegans*. *Petropedetes cameronensis* occurs in lowland forests on Bioko Island and in western Cameroon, including on Mt. Kupe where it extends up to approxiately 1,200 m and co-occurs with several other species of *Petropedetes* (Amiet 1975; Hofer et al. 1999; Barej et al. 2010).

*Petropedetes euskircheni* Barej, Rödel, Gonwouo, Pauwels, Böhme, and Schmitz, 2010. Figure 9H; three specimens. 4.8339°N, 9.7783°E (490 m): (2013) CAS 254068; 4.8500°N, 9.7673°E: (2013) CAS 254066–67. Two specimens exhibit tympanic papillae (a secondary sexual characteristic of males) and measure 48.0 mm (CAS 254067) and 60.0 mm (CAS 254068) SUL. The specimen lacking tympanic papillae is 48.0 mm (CAS 254066). Many adults were found on the vertical moss-covered rocks adjacent to a waterfall, and a small number of individuals were found perched on large boulders immediately upstream of the waterfall zone. *Petropedetes euskircheni* is known from ~900–1,200 m on Mt. Kupe (the type locality) and Mt. Nlonako, but our record extends its elevational distribution down to ~500 m.

## Phrynobatrachidae

*Phrynobatrachus africanus* (Hallowell, 1858). Figure 10A, B; eight specimens. 4.8406°N, 9.7793°E (491 m): (2014) CAS 256872. 4.8498°N, 9.7718 (513 m): (2013) CAS 253983–89. Unsexed specimens average 24.1 mm SUL (20.0–30.5 mm, $n = 8$). *Phrynobatrachus africanus* is a common lowland forest species known from nearby localities to the west (Amiet 1975) but not specifically on Mt. Kupe (Hofer et al. 1999) and extending from Cameroon and Nigeria south through mainland Equatorial Guinea and Gabon (Amiet 1975, 1978; Lasso et al. 2002; Burger et al. 2006; Pauwels and Rödel 2007).

*Phrynobatrachus auritus* Boulenger, 1900. Figure 10C–E; seven specimens. 4.8148°N, 9.7691°E (475 m): (2014) CAS 256669–75. A gravid female is 35.0 mm SUL (CAS 256674), and males average 31.9 mm SUL (28.5–31.0 mm, $n = 4$). This widespread species is found in lowland forests from Nigeria and Cameroon through mainland Equatorial Guinea, Gabon, and into Democratic Republic of Congo (Amiet 1975; Lasso et al. 2002; Burger et al. 2006; Pauwels and Rödel 2007; Nagy et al. 2013).

*Phrynobatrachus cornutus* (Boulenger, 1906). Figure 10F; five specimens. 4.8406°N, 9.7793°E (491 m): (2014) CAS 256868–71, 256873. A gravid female specimen (CAS 256873) is 17.0 mm SUL, and unsexed specimens average 12.6 mm (9.0–15.0 mm, $n = 4$). A small lowland species that is found on Bioko Island and extending through Cameroon and Central African Republic and south into Gabon (Perret 1988; Burger et al. 2006; Pauwels and Rödel 2006; Zimkus et al. 2010). *Phrynobatrachus cornutus* is easily confused with *P. calcaratus* (Peters, 1863) but the Cameroonian populations are genetically distinct from those that occur in more

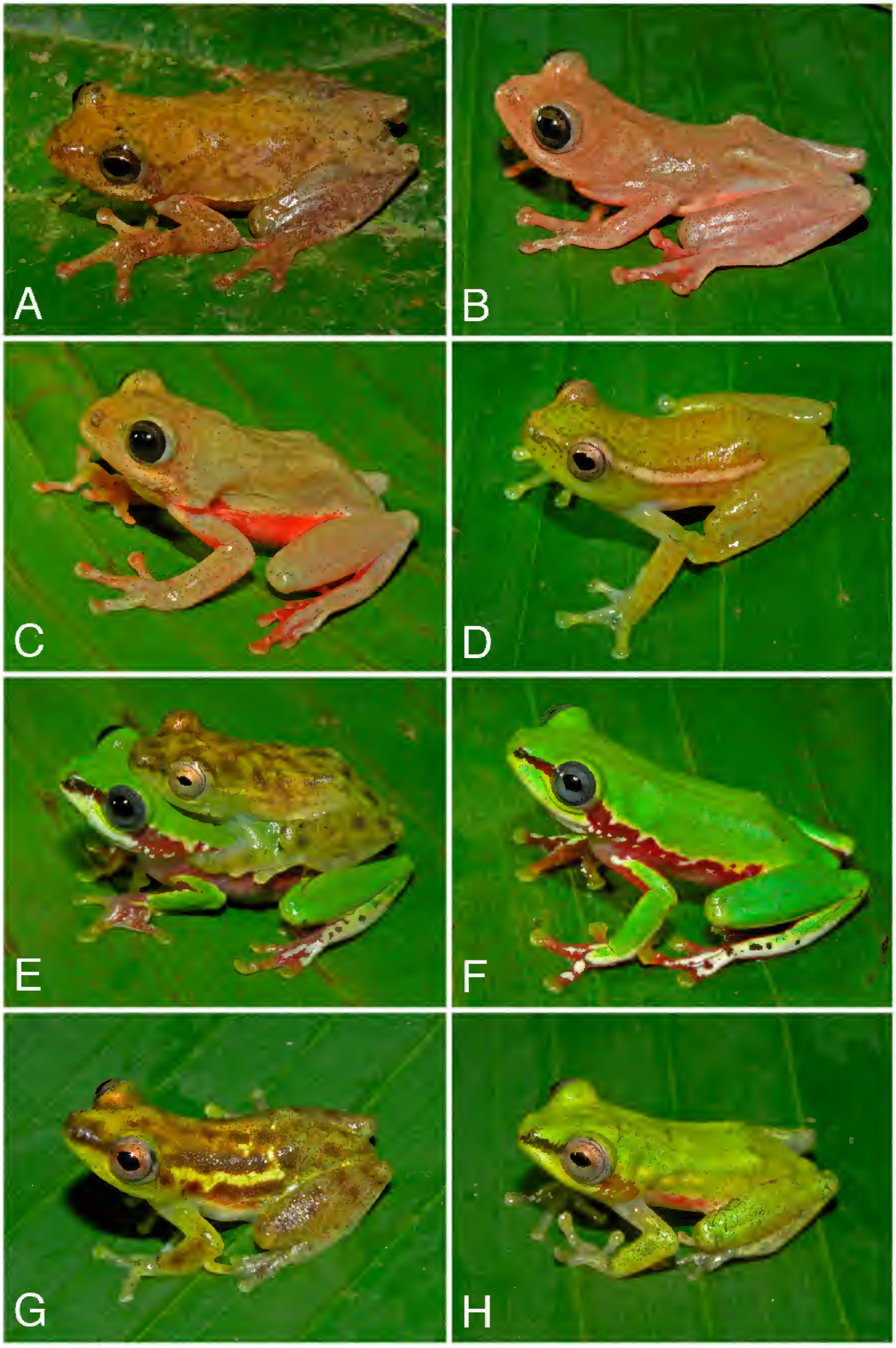


**Fig. 8.** Representatives of hyperoliid frog taxa. (**A**) *Hyperolius dintelmanni*, male (CAS 256841); (**B**) *Hyperolius dintelmanni*, female (CAS 256693); (**C**) *Hyperolius dintelmanni*, male (CAS 253991); (**D**) *Hyperolius* sp., male (CAS 256733); (E) *Hyperolius fusciventris*, amplexus (CAS 254007–08); (**F**) *Hyperolius fusciventris*, female (CAS 256815); (**G**) *Hyperolius fusciventris*, male (CAS 256700); (**H**) *Hyperolius fusciventris*, phase F male (CAS 256699).

western Africa and are referred to *P. calcaratus* (Zimkus et al. 2010).

*Phrynobatrachus* sp. Figure 10G, H; three specimens. 4.8406°N, 9.7793°E (491 m): (2014) CAS 256714–16. Two females measure 26.0 mm and 24.0 mm SUL (CAS 256714, 256716), whereas the single male measures 21.5 mm SUL (CAS 256715). The specific identity of these frogs remains unclear. Comparing the 16S DNA sequences to those available in GenBank, the specimens are most similar genetically (~6% uncorrected pairwise distance) to a specimen of *P. gutturosus* (GenBank EU718724) from Comoé National Park in Côte d'Ivoire.

### Ptychadenidae

*Ptychadena* cf. *aequiplicata*. Four specimens. 4.8498°N, 9.7718°E (513 m): (2013) CAS 254024, 254054–56. Three females were collected, measuring 65.0 mm (CAS 254054), 50.0 mm (CAS 254055), and 65.0 mm (CAS 254056) SUL. A single male was collected (CAS 254024) which is 51.0 mm SUL. These specimens were found at the edge of a flooded marsh near a plantation. DNA sequences of the mitochondrial 16S gene are genetically identical to GenBank sequences (e.g., AY517604) identified as "aff. *bibroni*" by Dehling and Sinsch (2013). The taxonomy of *Ptychadena* in Central Africa remains confusing, including for species such as *P. aequiplicata* and *P. bibroni*. These specimens are considerably larger than noted for *P. bibroni* (34–48 mm SUL for males; 34–56 mm SUL for females) by Rödel (2000). We follow Amiet (1975) and Herrmann et al. (2005) who identified *P. aequiplicata* as present on and near Mt. Nlonako.

*Ptychadena* cf. *mascareniensis*. Two specimens. 4.8498°N, 9.7718°E (513 m): (2013) CAS 254083–84. Both specimens are males, and measure 49.0 mm and 47.0 mm SUL, respectively. Both specimens were found at the edge of a flooded marsh near a plantation. Genetically, these two specimens are nearly identical to specimens (i.e., AF215408; AY517597) that belong to a clade found in western and central Africa and referred to as "cf. *mascareniensis*" by Dehling and Sinsch (2013).

*Ptychadena oxyrhynchus*. Two specimens. 4.8406°N, 9.7793°E (491 m): (2014) CAS 256820, 256862. Both specimens are males, and measure 57.0 mm and 56.0 mm SUL, respectively. As currently recognized, this savanna species is widespread across Africa (Rödel 2000; Channing 2001).

### Rhacophoridae

*Chiromantis rufescens* Günther, 1869. Figure 11A, B; Five specimens. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256708. 4.8498°N, 9.7718°E (513 m): (2013) CAS 254025–28. Four males were collected, each measuring 44.0 mm SUL (CAS 254025–28), along with a single female measuring 72.0 mm SUL (CAS 256708). Foam nests were observed on the vegetation pictured in Fig. 2A, and adults were found around the permanent ponds near a plantation. This lowland forest species is widely distributed across western and central Africa (Noble 1924; Lasso et al. 2002; Burger et al. 2006; Hillers and Rödel 2007) including Cameroon (Amiet 1975, 1978, 1983; Herrmann et al. 2005) and it was previously documented on Mt. Kupe by Hofer et al. (1999).

## SQUAMATA – LIZARDS

### Agamidae

*Agama lebretoni* Wagner, Barej and Schmitz, 2009. Four specimens. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256858. 4.8247°N, 9.7702°E (494 m): (2013) CAS 253878–80. One adult female was collected (120.0 mm SVL, 167.0 mm tail length; CAS 253879) along with three juveniles ranging from 49.5 mm to 73.5 mm SVL. They were abundant on the houses and other artificial structures in the town of Manjo. While only recently described, this species is widely distributed in western Cameroon and also found on Bioko Island and in Gabon (Chirio and LeBreton 2007; Wagner et al. 2009).

### Gekkonidae

*Cnemaspis spinicollis* (Müller, 1907). Figure 11C; one specimen. 4.8506°N, 9.7671°E (541 m): (2014) CAS 256886. An adult female (53.0 mm SVL, 57.0 mm tail length) was collected while active at night on rocks adjacent to a large stream. *Cnemaspis spinicollis* is found in forests of western and central Africa (Bauer et al. 2006; Chirio and LeBreton 2007) and previously documented on Mt. Kupe (Hofer et al. 1999).

### Lacertidae

*Poromera fordii* (Hallowell, 1857). Figure 11D; one specimen. 4.8498°N, 9.7718°E (513 m): (2013) CAS 254085. An adult male of this colorful species was collected while sleeping at night in the vegetation of a permanent pond. It measures 46.0 mm SVL with a tail length of 112.0 mm. This species occurs in forests across a broad elevation range (near sea level to ~1,300 m) in Central Africa, including Cameroon, Gabon, Equatorial Guinea (Lasso et al. 2002; Chirio and LeBreton 2007; Pauwels et al. 2008). It was not recorded on Mt. Kupe by Hofer et al. (1999).

### Scincidae

*Panaspis breviceps* (Peters, 1873). Figure 11E; one specimen. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256855. Specimen measures 52.5 mm SVL with 81.5 mm tail

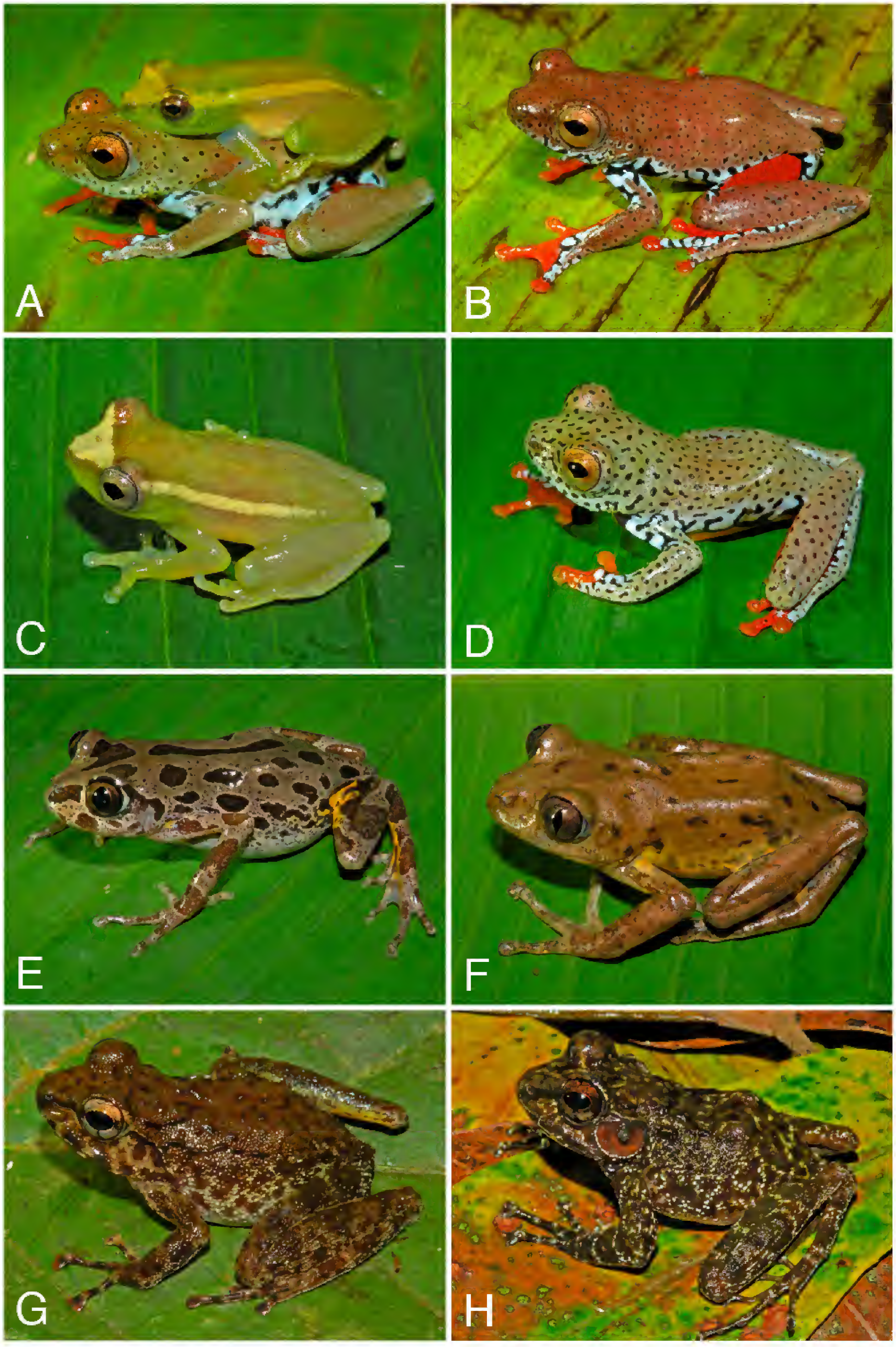


**Fig. 9.** Representatives of hyperoliid and petropedetid frog taxa. (**A**) *Hyperolius ocellatus*, amplexus (CAS 254057–58); (**B**) *Hyperolius ocellatus*, female (CAS 256838); (**C**) *Hyperolius ocellatus*, male (CAS 256704); (**D**) *Hyperolius ocellatus*, female (CAS 254076); (**E**) *Kassina decorata* (CAS 253990); (**F**) *Phlyctimantis leonardi*, male (CAS 253979); (**G**) *Petropedetes cameronensis* (CAS 256887); (**H**) *Petropedetes euskircheni*, male (CAS 254068).

length. This specimen was collected while active on the ground near fish ponds. *Panaspis breviceps* is a common lowland species found across Central Africa (Chirio and LeBreton 2007; Pauwels et al. 2008). It was not recorded on Mt. Kupe by Hofer et al. (1999).

*Trachylepis affinis* (Gray, 1838). Figure 11F; three specimens. 4.8148°N, 9.7691°E (475 m): (2014) CAS 256707. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256856–57. The three specimens differ in size: CAS 256856, 48.5 mm SVL + 90.5 mm tail length; CAS 256707, 61.0 mm SVL + 119.0 mm tail length; CAS 256857, 80.0 mm SVL + 125.0 mm tail length. The morphological identification of these specimens was confirmed by a comparison of 16S data with that of Allen (2015). Specimens were collected on agricultural plantations near to either ponds or small streams. A common species, *T. affinis* occurs across a broad elevational range (sea level to ~1,200 m) across western and Central Africa (Chirio and LeBreton 2007), though Hofer et al. (1999) previously recorded only one individual on Mt. Kupe at 900 m.

*Trachylepis maculilabris* (Gray, 1845). Three specimens. 4.8497°N, 9.7719°E (510 m): (2014) CAS 256792. 4.8247°N, 9.7702°E (494 m): (2013) CAS 253881–82. The three specimens differ in size: CAS 253881, 47.0 mm SVL + 80.0 mm tail length; CAS 253882, 52.5 mm SVL + 102.0 mm tail length; CAS 256792, 89.0 mm SVL + 154.0 mm tail length. The morphological identification of these specimens was confirmed by a comparison of 16S data with that of Allen (2015). Specimens were collected near roadside ditches (CAS 253881–82) or on agricultural plantations (CAS 256792). *Trachylepis maculilabris* is among the most widely distributed skink species in Africa and occurs across an extremely broad elevational range in Cameroon (sea level to >2,550 m), but surprisingly was not previously recorded on Mt. Kupe by Hofer et al. (1999).

### Varanidae

*Varanus niloticus* (Linnaeus, 1766). 4.8506°N, 9.7671°E (541 m): (2014) DMP 1698. A juvenile was collected at night, and was found sleeping in a tree overhanging a larger section of the stream in secondary forest illustrated in Fig. 2D. This locality is within the described range for *V. ornatus*, but based on a large molecular analysis with extensive geographic sampling Dowell et al. (2016) recently proposed *V. ornatus* be recognized as a synonym of *V. niloticus*.

## SQUAMATA – SNAKES

### Colubridae

*Dipsadoboa duchesnii* (Boulenger, 1901). One specimen. 4.8498°N, 9.7718°E (513 m): (2013) CAS 254086. We collected a male specimen (330.0 mm SVL + 90.0 mm tail length) near a marsh on a plantation. A lowland species, *D. duchesnii* has a broad distribution in the forests of Central Africa (Chirio and LeBreton 2007; Trape and Baldé 2014). Hofer et al. (1999) report both *D. unicolor* and one unidentified *Dipsadoboa* from Mt. Kupe, but it is unclear if the latter might correspond to *D. duchesnii*.

*Grayia ornata* (Bocage, 1866). Figure 11H; one specimen. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256859. We collected a single specimen (415.0 mm SVL + 150.0 mm tail length) at a fish pond near a fast-flowing stream. Being piscivorous, *G. ornata* is frequently encountered in or near water in Central African lowland forests (Chirio and LeBreton 2007), but was not recorded on Mt. Kupe by Hofer et al. (1999).

*Hapsidophrys smaragdinus* (Schlegel, 1837). Figure 11G; two specimens. 4.8551°N, 9.8188°E (560 m): (2014) CAS 256860–61. CAS 256860 is 667.0 mm in total length (425.0 mm SVL + 242.0 mm tail length); CAS 256861 is 402.0 mm in total length (267.0 mm SVL + 135.0 mm tail length). Both specimens were collected near fish ponds on plantations near Manjo. A widespread African snake, *H. smaragdinus* is common in forests but also in plantations and near human habitation (Chirio and LeBreton 2007).

## Discussion

Our ten days of survey work in the foothills of Mt. Kupe produced a total of 48 species, including 38 amphibian and 10 reptile species (Table 2). The amphibians sampled belong to eight families: Arthroleptidae (12 species), Bufonidae (two species), Conrauidae (two species), Hyperoliidae (12 species), Petropedetidae (two species), Phrynobatrachidae (four species), Ptychadenidae (three species), and Rhacophoridae (one species). We encountered seven lizard species in five families (Agamidae, Gekkonidae, Lacertidae, Scincidae, Varanidae), and three snake species in the family Colubridae. Although our work was not conducted using a systematic sampling technique, we observed qualitative differences in the relative abundances of species within these families. We collected 471 amphibian specimens, and of this total, 304 specimens are hyperoliid frogs (64% of amphibian specimens), 118 are arthroleptid frogs (25% of amphibian specimens), and 49 specimens are split among the remaining six frog families (11% of amphibian specimens). Among the hyperoliid species we collected, several were abundant (*Afrixalus dorsalis*, *A. paradorsalis*, *Hyperolius bolifambae*, *H. camerunensis*, *H. concolor*, *H. fusciventris*, *H. ocellatus*) but a few species were rarely encountered (*Afrixalus laevis*, *Hyperolius dintelmanni*, *Kassina decorata*, *Phlyctimantis leonardi*). In contrast, only three arthroleptid species had relatively high abundances (*Arthroleptis poecilonotus*, *Leptopelis rufus*,

**Table 2.** Checklist of the amphibians and reptiles of the greater Mt. Kupe region. Comparisons to Amiet (1975) are based on three sites (Lala, 480 m; Maholé, 300–350 m; Nlohé, 350 m) and only include amphibians. Information from S & E comes from Schmitz et al. (1999, 2000) and Euskirchen et al. (1999, 2000) for surveys on Mt. Kupe, though elevations for the records on Mt. Kupe are not always noted.

| | Present study <1,000 m | Amiet (1975) 300–480 m | Hofer et al. (1999) 900–1,500 m | Hofer et al. (1999) 1,500–2,000 m | Hofer et al. (1999) elevation not reported | S & E |
|---|---|---|---|---|---|---|
| **Amphibia** | | | | | | |
| **Anura** | | | | | | |
| **Arthroleptidae (26)** | | | | | | |
| *Arthroleptis adelphus* | — | + | + | — | — | + |
| *Arthroleptis perreti* | — | — | + | + | — | — |
| *Arthroleptis poecilonotus* | + | — | — | — | — | — |
| *Arthroleptis variabilis* | — | — | + | — | — | — |
| *Astylosternus diadematus* | — | + | + | — | — | — |
| *Astylosternus laurenti* | — | + | — | — | — | — |
| *Astylosternus montanus* | — | — | + | — | — | — |
| *Astylosternus perreti* | — | — | + | — | — | — |
| *Cardioglossa elegans* | + | + | — | — | + | — |
| *Cardioglossa gracilis* | — | + | + | — | — | — |
| *Cardioglossa leucomystax* | + | + | — | — | — | — |
| *Cardioglossa nigromaculata* | — | + | — | — | — | — |
| *Cardioglossa venusta* | — | — | + | — | — | — |
| *Leptodactylodon bicolor* | — | — | — | — | + | — |
| *Leptodactylodon ornatus* | — | — | + | — | — | — |
| *Leptodactylodon ovatus* | + | + | — | — | — | — |
| *Leptopelis aubryi* | + | + | — | — | — | — |
| *Leptopelis aubryioides* | + | — | — | — | — | — |
| *Leptopelis boulengeri* | + | — | — | — | — | — |
| *Leptopelis brevirostris* | — | + | + | — | — | — |
| *Leptopelis calcaratus* | + | + | + | — | — | — |
| *Leptopelis modestus* | — | — | + | + | — | — |
| *Leptopelis rufus* | + | + | + | — | — | + |
| *Nyctibates corrugatus* | + | + | — | — | — | — |
| *Scotobleps gabonicus* | + | + | — | — | — | — |
| *Trichobatrachus robustus* | + | + | + | — | — | 850 m |
| **Bufonidae (9)** | | | | | | |
| *Sclerophrys gracilipes* | — | — | + | — | — | — |
| *Sclerophrys regularis* | + | — | — | — | — | — |
| *Sclerophrys superciliaris* | + | — | — | — | — | — |
| *Sclerophrys tuberosa* | — | — | + | — | — | — |
| *Nectophryne afra* | — | — | — | — | + | — |
| *Nectophryne batesi* | — | — | — | — | + | — |
| *Werneria mertensiana* | — | + | — | — | — | — |
| *Werneria preussi* | — | — | + | — | — | — |
| *Wolterstorffina parvipalmata* | — | — | + | + | — | + |
| **Conrauidae (3)** | | | | | | |
| *Conraua crassipes* | — | + | — | — | — | — |

**Table 2 (Continued).** Checklist of the amphibians and reptiles of the greater Mt. Kupe region. Comparisons to Amiet (1975) are based on three sites (Lala, 480 m; Maholé, 300–350 m; Nlohé, 350 m) and only include amphibians. Information from S & E comes from Schmitz et al. (1999, 2000) and Euskirchen et al. (1999, 2000) for surveys on Mt. Kupe, though elevations for the records on Mt. Kupe are not always noted.

| | Present study <1,000 m | Amiet (1975) 300–480 m | Hofer et al. (1999) 900–1,500 m | Hofer et al. (1999) 1,500–2,000 m | Hofer et al. (1999) elevation not reported | S & E |
|---|---|---|---|---|---|---|
| *Conraua goliath* | + | — | — | — | — | — |
| *Conraua robusta* | + | + | + | — | — | + |
| **Hyperoliidae (18)** | | | | | | |
| *Acanthixalus spinosus* | — | — | — | — | + | 945 m |
| *Afrixalus dorsalis* | + | + | — | — | — | — |
| *Afrixalus lacteus* | — | — | + | + | — | — |
| *Afrixalus laevis* | + | + | — | — | + | — |
| *Afrixalus paradorsalis* | + | + | — | — | — | — |
| *Alexteroon obsetricans* | — | + | — | — | — | — |
| *Arlequinus krebsi* | — | + | — | — | — | — |
| *Hyperolius bolifambae* | + | + | — | — | — | — |
| *Hyperolius camerunensis* | + | — | — | — | — | — |
| *Hyperolius concolor* | + | + | — | — | — | — |
| *Hyperolius dintelmanni* | + | — | — | — | — | — |
| *Hyperolius fusciventris* | + | — | — | — | — | — |
| *Hyperolius guttulatus* | — | + | — | — | — | — |
| *Hyperolius ocellatus* | + | + | — | — | — | — |
| *Hyperolius* sp. | + | — | — | — | — | — |
| *Kassina decorata* | + | — | — | — | — | — |
| *Opisthothylax immaculatus* | — | + | — | — | — | — |
| *Phlyctimantis leonardi* | + | — | — | — | — | — |
| **Petropedetidae (5)** | | | | | | |
| *Petropedetes cameronensis* | + | + | + | — | — | — |
| *Petropedetes euskircheni* | + | — | — | — | — | — |
| *Petropedetes newtoni* | — | + | + | — | — | — |
| *Petropedetes parkeri* | — | — | + | — | — | + |
| *Petropedetes perreti* | — | — | + | — | — | — |
| **Phrynobatrachidae (6)** | | | | | | |
| *Phrynobatrachus africanus* | + | + | — | — | — | — |
| *Phrynobatrachus auritus* | + | + | — | — | — | — |
| *Phrynobatrachus cornutus* | + | — | — | — | — | — |
| *Phrynobatrachus cricogaster* | — | — | + | + | — | + |
| *Phrynobatrachus* sp. | + | — | — | — | — | — |
| *Phrynobatrachus werneri* | — | — | — | + | — | — |
| **Ptychadenidae (3)** | | | | | | |
| *Ptychadena* cf. *aequiplicata* | + | — | — | — | — | — |
| *Ptychadena* cf. *mascariensis* | + | — | — | — | — | — |
| *Ptychadena oxyrhynchus* | + | — | — | — | — | — |
| **Ranidae (1)** | | | | | | |
| *Amnirana albolabris* | — | + | — | — | — | — |
| **Rhacophoridae (1)** | | | | | | |

**Table 2 (Continued).** Checklist of the amphibians and reptiles of the greater Mt. Kupe region. Comparisons to Amiet (1975) are based on three sites (Lala, 480 m; Maholé, 300–350 m; Nlohé, 350 m) and only include amphibians. Information from S & E comes from Schmitz et al. (1999, 2000) and Euskirchen et al. (1999, 2000) for surveys on Mt. Kupe, though elevations for the records on Mt. Kupe are not always noted.

| | Present study <1,000 m | Amiet (1975) 300–480 m | Hofer et al. (1999) 900–1,500 m | Hofer et al. (1999) 1,500–2000 m | ,Hofer et al. (1999) elevation not reported | S & E |
|---|---|---|---|---|---|---|
| *Chiromantis rufescens* | + | + | — | — | + | — |
| **Reptilia** | | | | | | |
| **Squamata (Lizards)** | | | | | | |
| **Agamidae (1)** | | | | | | |
| *Agama lebretoni* | + | | — | — | — | — |
| **Chamaeleondidae (4)** | | | | | | |
| *Trioceros montium* | — | | + | — | — | + |
| *Trioceros pfefferi* | — | | + | + | — | + |
| *Trioceros quadricornis* | — | | + | + | — | + |
| *Rhampholeon spectrum* | — | | + | + | — | + |
| **Gekkonidae (4)** | | | | | | |
| *Cnemaspis koehleri* | — | | + | + | — | — |
| *Cnemaspis spinicollis* | + | | — | — | + | — |
| *Hemidactylus echinus* | — | | + | — | — | — |
| *Hemidactylus fasciatus* | — | | + | — | — | — |
| **Lacertidae (2)** | | | | | | |
| *Adolfus africanus* | — | | — | — | + | — |
| *Poromera fordii* | + | | — | — | — | — |
| **Scincidae (9)** | | | | | | |
| *Lacertaspis chriswildi* | — | | — | — | + | — |
| *Lacertaspis rohdei* | — | | + | — | — | + |
| *Lepidothyris fernandi* | — | | — | — | — | + |
| *Leptosiaphos* sp. A | — | | + | + | — | — |
| *Leptosiaphos* sp. B | — | | — | + | — | — |
| *Leptosiaphos* sp. C | — | | + | — | — | — |
| *Panaspis breviceps* | + | | — | — | — | — |
| *Trachylepis affinis* | + | | + | — | — | — |
| *Trachylepis maculilabris* | + | | — | — | — | — |
| **Varanidae (1)** | | | | | | |
| *Varanus niloticus* | + | | — | — | — | + |
| **Squamata (Snakes)** | | | | | | |
| **Boidae (1)** | | | | | | |
| *Calabaria reinhardti* | — | | + | — | — | — |
| **Colubridae (6)** | | | | | | |
| *Dipsadoboa duchesnii* | + | | — | — | — | — |
| *Dipsadoboa unicolor* | — | | — | — | + | — |
| *Grayia inornata* | + | | — | — | — | — |
| *Hapsidophrys smaragdinus* | + | | — | — | — | — |
| *Rhamnophis aethiopissa* | — | | — | — | + | — |

**Table 2 (Continued).** Checklist of the amphibians and reptiles of the greater Mt. Kupe region. Comparisons to Amiet (1975) are based on three sites (Lala, 480 m; Maholé, 300–350 m; Nlohé, 350 m) and only include amphibians. Information from S & E comes from Schmitz et al. (1999, 2000) and Euskirchen et al. (1999, 2000) for surveys on Mt. Kupe, though elevations for the records on Mt. Kupe are not always noted.

| | Present study <1,000 m | Amiet (1975) 300–480 m | Hofer et al. (1999) 900–1,500 m | Hofer et al. (1999) 1,500–2,000 m | Hofer et al. (1999) elevation not reported | S & E |
|---|---|---|---|---|---|---|
| *Toxicodryas pulverulenta* | — | | — | — | + | — |
| **Elapidae (2)** | | | | | | |
| *Dendroaspis jamesoni* | — | | — | — | — | + |
| *Naja melanoleuca* | — | | — | — | — | + |
| **Lamprophiidae (4)** | | | | | | |
| *Bothrolycus ater* | — | | + | — | — | — |
| *Buhoma depressiceps* | — | | + | + | — | — |
| *Chamaelycus fasciatus* | — | | + | — | — | — |
| *Gonionotophis guirali* | — | | + | — | — | — |
| **Viperidae (2)** | | | | | | |
| *Atheris squamiger* | — | | — | — | + | — |
| *Bitis gabonica* | — | | + | — | — | 850 m |

*Scotobleps gabonicus*), but we detected several arthroleptid species through the collection of only one or two specimens (*Cardioglossa leucomystax*, *Leptodactylodon ovatus*, *Leptopelis boulengeri*, *L. calcaratus*, *Nyctibates corrugatus*). By combining our survey results with those of Hofer et al. (1999, 2000) as well as previous work by Amiet (1975) and others, we have produced a checklist of 108 species of reptiles and amphibians for the greater Mt. Kupe region (Table 2). This includes 72 frog species, 21 lizard species, and 15 species of snakes.

Prior to our work, Hofer et al. (1999) performed transects of higher elevation regions (900–2,000 m) and some opportunistic lower elevation sampling of Mt. Kupe. Across this elevation range, they documented a total of 57 species, including 33 amphibian and 25 reptile species (Table 2). Our survey work at lower elevations uncovered an additional 30 species of frogs not detected by Hofer et al. (1999), which can largely be explained by the availability of suitable breeding habitat. The temporary pools and permanent ponds present at lower elevation sites are likely facilitating the occurrence of species of *Sclerophrys*, *Ptychadena*, *Phrynobatrachus*, and *Leptopelis*, as well as the hyperoliid frogs (*Afrixalus*, *Hyperolius*, *Kassina*, *Phlyctimantis*). We collected twelve species of hyperoliids during our work, eleven of which were not found previously at higher elevations by Hofer et al. (1999). These particular species use lentic water systems for breeding, features that are rare or absent from higher elevation sites around Mt. Kupe due to increased slope. The only amphibian species detected during all surveys and across several elevational gradients are forest stream (lotic) breeders (*Cardioglossa elegans*, *Leptopelis rufus*, *Trichobatrachus robustus*, *Conraua robusta*, *Afrixalus laevis*, *Petropedetes cameronensis*), suggesting this is one of the few habitats present across elevation zones.

Several Cameroonian herpetological surveys have focused on montane regions including Mt. Cameroon (Gonwouo et al. 2007), Mt. Nlonako (Herrmann et al. 2005a, 2005b), Takamanda Forest Reserve (LeBreton et al. 2003), Mt. Oku (Ineich et al. 2015), and Tchabal Mbabo (Herrmann et al. 2006). Surveys in lower elevation regions have also been conducted, including in Korup National Park (Lawson 1993) and Dja Reserve (LeBreton 1999). The focus of a majority of these studies has been on reptiles, with few researchers reporting results for both reptiles and amphibians. Though these surveys each differ in collection technique, sampling effort, and geographic scope, they do provide a baseline estimate for herpetological diversity across several regions. Studies providing data for both amphibians and reptiles include survey work at Mt. Nlonako (182 total species), Korup National Park (171 total species), Tchabal Mbabo (30 total species), and our present summary of Mt. Kupe (108 total species).

In Cameroon the highest documented reptile diversity occurs at Mt. Nlonako, with over 89 species reported (Herrmann et al. 2005b), followed by 86 species for Mt. Cameroon (Gonwouo et al. 2007), 83 species for Korup National Park (Lawson 1993), 80 species for Dja Reserve (LeBreton 1999), 71 species for Takamanda Forest Reserve (LeBreton et al. 2003), 50 species for Mt. Oku (Ineich et al. 2015), 36 species for Mt. Kupe (present study), and 15 species for Tchabal Mbabo (Herrmann et al. 2006). A large proportion of this diversity can be attributed to snakes, which are often difficult to encounter during visual surveys. Our study and the study of Hofer

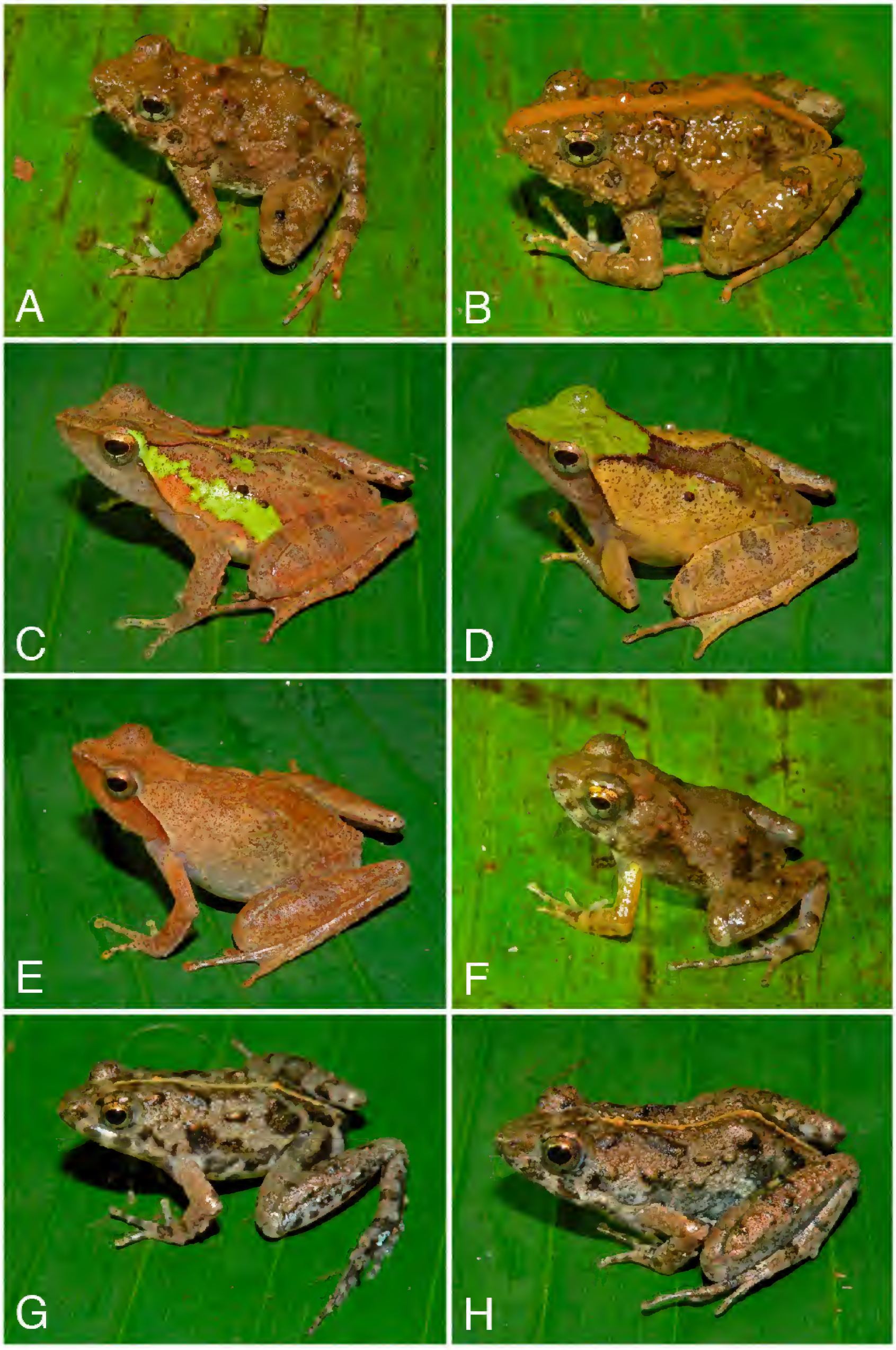


**Fig. 10.** Representatives of phrynobatrachid frog taxa. (**A**) *Phrynobatrachus africanus* (CAS 256872); (**B**) *Phrynobatrachus africanus* (CAS 253989); (**C**) *Phrynobatrachus auritus*, male (CAS256670); (**D**) *Phrynobatrachus auritus*, male (CAS 256669); (**E**) *Phrynobatrachus auritus*, female (CAS 256674); (**F**) *Phrynobatrachus cornutus* (representative from series CAS 256868–71); (**G**) *Phrynobatrachus* sp. (CAS 256714); (**H**) *Phrynobatrachus* sp. (CAS 256715).

et al. (1999) did not employ funnel or pit fall traps, and as a result we believe the 15 species of snakes currently documented for Mt. Kupe is not representative of the true snake diversity. The lizard diversity of Mt. Kupe includes at least 21 species, which is comparable to the diversity detected at Mt. Oku (18 species; Ineich et al. 2015), Mt. Cameroon (27 species; Gonwouo et al. 2007), and Mt. Nlonako (22 species; Herrmann et al. 2005b). The highest amphibian diversity in Cameroon also occurs at Mt. Nlonako, with 93 amphibian species recorded (Herrmann et al. 2005a), followed by 89 species for Mt. Manengouba (Hirschfeld et al. 2016), 88 species for Korup National Park (Lawson 1993), 72 species for Mt. Kupe (present study), and 15 amphibian species for Tchabal Mbabo (Herrmann et al. 2006). Overall, with at least 72 amphibian and 36 reptile species, the greater area of Mt. Kupe is an important center of biodiversity in Cameroon and is comparable in richness to other montane biodiversity hotspots.

Given the close geographic proximity of Mt. Kupe to Mt. Nlonako, we expect strong biogeographic ties between these mountains, particularly of the lower elevation fauna. The thorough sampling of Mt. Nlonako allows an initial biogeographic comparison of species we have compiled for Mt. Kupe. We find that at least 50 amphibians are found in both sites, along with 21 species of reptiles, which represents 74% of the species documented for Mt. Kupe. Many of these shared reptile species are found at lower elevations, though some are only present at higher elevations (species of *Leptosiaphos*, *Trioceros*, *Hemidactylus echinus*). Of the 50 amphibians, close to 40 are species found at lower elevations (in the following genera: *Afrixalus*, *Chiromantis*, *Hyperolius*, *Leptopelis*, *Nectoprhyne*, *Nyctibates*, *Petropedetes*, *Phrynobatrachus*, *Ptychadena*, *Sclerophrys*, *Scotobleps*, *Trichobatrachus*). There are fewer higher elevation species found in common on both mountains, but include *Afrixalus lacteus*, *Arthroleptis perreti*, *Astylosternus montanus*, *Cardioglossa venusta*, *Leptodactylodon bicolor*, *Leptodactylodon ornatus*, *Leptopelis modestus*, *Phrynobatrachus cricogaster*, *Sclerophrys tuberosa*, and *Woltersorffina parvipalmata*. The close proximity of Mt. Kupe to other mountains (Mt. Manengouba, Mt. Nlonako), combined with historical fluctuations in climate, has produced an island-like geographic range distribution for many of these higher elevation taxa.

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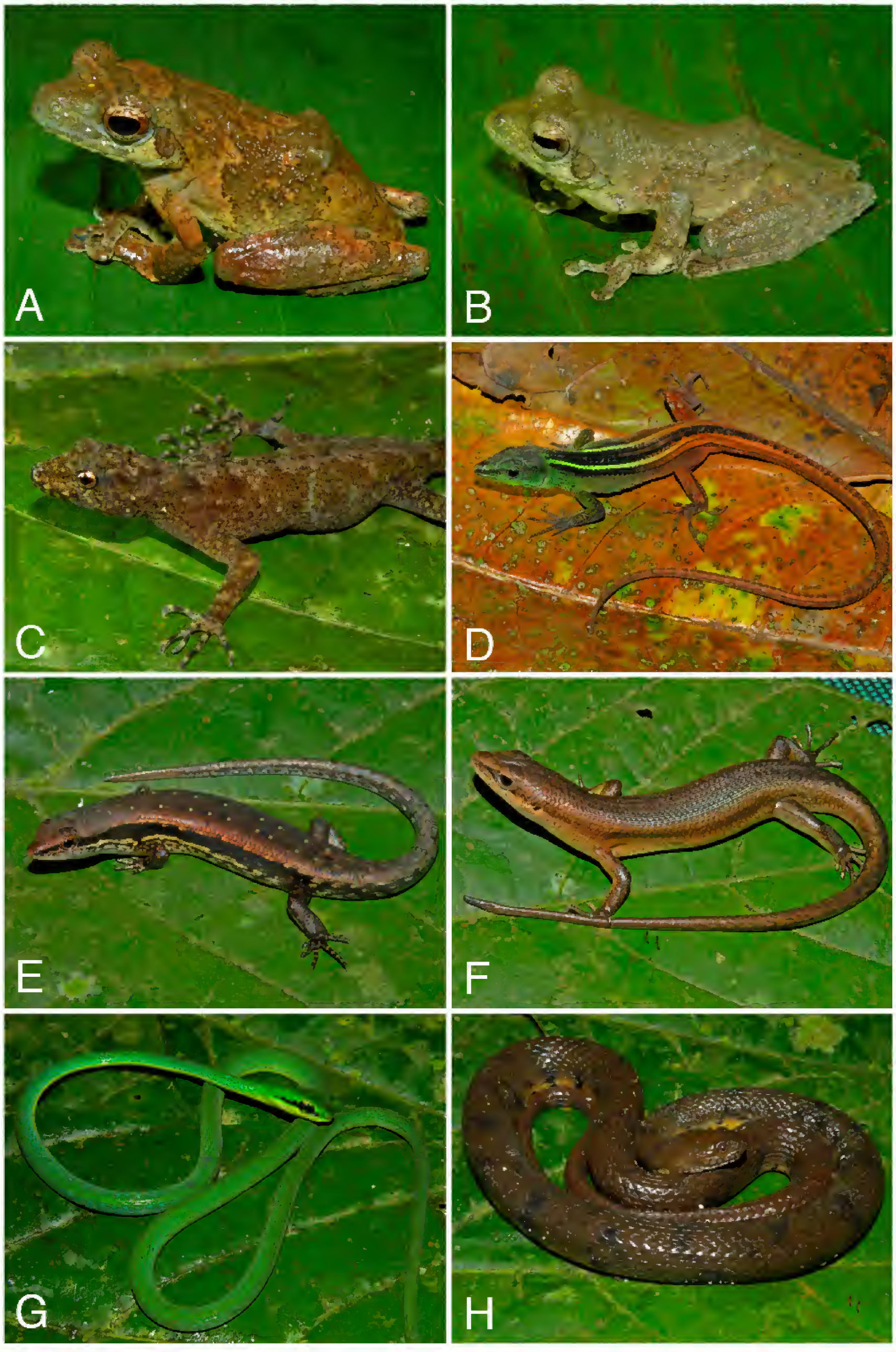


**Fig. 11.** Representatives of rhacophorid, gekkonid, lacertid, skink, and colubrid taxa. (**A**) *Chiromantis rufescens* (CAS 256708); (**B**) *Chiromantis rufescens* (CAS 254028); (**C**) *Cnemaspis spinicollis* (CAS 256886); (**D**) *Poromera fordii* (CAS 254085); (**E**) *Panaspis breviceps* (CAS 256855); (**F**) *Trachylepis affinis* (CAS 256857); (**G**) *Hapsidophrys smaragdinus* (CAS 256860); (**H**) *Grayia ornata* (CAS 256859).

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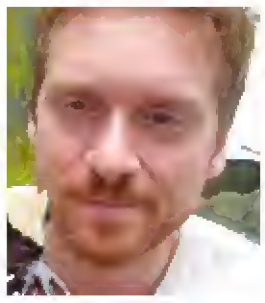

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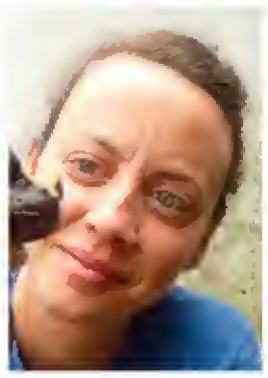

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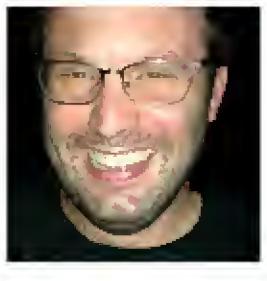

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